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UNITED STATES NATIONAL MUSEUM
Bulletin 104

THE FORAMINIFERA OF THE ATLANTIC OCEAN

PART I. ASTRORHIZIDAE

BY

JOSEPH AUGUSTINE CUSHMAN
Of the Boston Society of Natural History

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The present work forms No. 104 of the *Bulletin* series.

RICHARD RATHBUN,
Assistant Secretary, Smithsonian Institution,
In charge of the United States National Musuem.

WASHINGTON, D. C., June 10, 1918.

INTRODUCTION.

This paper is the first part of a work the intent of which is to describe and illustrate the Foraminifera of the Atlantic Ocean, especially those species which have occurred in the waters adjacent to the shores of the United States, including the whole of the Gulf of Mexico and the Caribbean Sea, that being the area in which most of the work of the vessels of the United States engaged in dredging work has been done. This part includes only the family Astrorhizidae, which is the most primitive of any of the group.

The various vessels of the United States Bureau of Fisheries, including the *Bache*, *Bluelight*, *Speedwell*, *Fish Hawk*, and especially the *Albatross*, have accumulated a mass of dredged material consisting of thousands of samples which fairly well represent the bottom of the area mentioned. Besides, there are available a great many of the samples of bottom obtained by the United States Coast and Geodetic Survey. Other collections have also been used as will be mentioned later.

Except for the work of Dr. James M. Flint, published in 1899, there is almost nothing published which deals in any considerable amount with the foraminifera of this region. The region of the North Sea and the waters about the British Isles have been the source of a great mass of published records and a comparison with that area is very interesting.

I wish here to express my deep appreciation of the many kindnesses and abundant help which the United States National Museum and its staff have so unstintingly given me in the study of this material and in the preparation of this work.

JOSEPH AUGUSTINE CUSHMAN.

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THE FORAMINIFERA OF THE ATLANTIC OCEAN.

ASTRORHIZIDAE.

By Joseph Augustine Cushman,
Of the Boston Society of Natural History.

GENERAL ACCOUNT.

In a previous work on the Foraminifera of the North Pacific Ocean[1] the writer has given a general account of the Foraminifera. For a more lengthy and detailed account the reader is referred to Chapman's volume on the Foraminifera, 1902.

From the fact that much of the work on Recent Foraminifera has been done by English and French workers the area about the British Isles and the immediate coast of Europe is better known than any other region. As a result the known foraminiferal fauna of the eastern North Atlantic is very considerable. The work of Sars, Goës, Williamson, Parker, Jones, H. B. Brady, Robertson, Siddall, Chaster, Wright, Sidebottom, Heron-Allen, Earland, Pearcey, D'Orbigny, Schlumberger, de Folin, Schaudinn, Rhumbler, and many others has made a formidable mass of literature on the recent foraminifera of this region. From the western Atlantic Bailey, Goës, and Flint especially have given us many records from the American coast including the West Indies.

From the deeper regions the *Challenger* expedition with those of the *Porcupine, Knight Errant, Goldseeker, Albatross,* and many other expeditions have added greatly to the mass of records from this ocean basin.

The Atlantic being shallower than the North Pacific has much greater deposits of globigerina ooze with comparatively small areas of red clay. The great development of shallow water continental shelf areas on the Atlantic coasts of Europe and America makes prolific areas for many species, while the coral reefs of the warmer regions of the West Indies give a great development of the characteristic species of such warm waters.

That there are very well developed areas of distribution is shown by the records of the species of this single family. As a rule, the

[1] Bulletin 71, U. S. Nat. Mus., 1910–1917.

arenaceous foraminifera are characteristic of cooler and deeper waters and they are much more abundant on the American side at corresponding latitudes than on the European side as a result of the difference in oceanic temperature conditions due to the opposite influence of the warm Gulf Stream on Europe and the cold Greenland current on the American side. As with mollusca, echinoderms, and other groups, several areas of distribution seem to be distinguishable on our own eastern coast. The region north of Cape Cod and Georges Banks is very different from the region to the south of this area. Another very definite line of demarcation seems to be the region of Cape Hatteras. Many of the northern species seem not to go south of this line, and their distribution is apparently largely determined in this region by temperature conditions. The limits of distribution of the species of warmer waters will be more graphically shown by other groups of species rather than those of this family.

A series of maps has been kindly furnished by the United States National Museum, and these have been used to plot the recorded distribution of each species. By this means definite distributional areas are more or less distinctly made out, although data from many areas is yet unavailable.

SOURCES OF MATERIAL AND RECORDS.

The main source of material for the present work has been the dredgings and hydrographic soundings of the United States Bureau of Fisheries steamer *Albatross*, for this family especially the dredgings which are much more likely to have an abundance of the coarser material than the hydrographic soundings. In addition the work at an earlier time of the *Bache*, *Bluelight*, and *Speedwell* off the coast of New England has added considerably, especially in the way of rock specimens. The *Fish Hawk* has been dredging for many years in the shallower water off our Atlantic coasts and the accumulated material of the United States Coast and Geodetic Survey has also been available but in small samples and usually from very shallow waters. Altogether, however, the amount of material from our Atlantic coast is very considerable. Although of little use in this present family the material dredged by Henderson and Bartsch in the various parts of the West Indies and along the Florida coast will be very useful in supplementing the deeper water material from this region.

With the work of the *Porcupine* and *Knight Errant* expeditions and the North Polar and Austro-Hungarian expeditions recorded in the *Challenger* report, together with the work of Goës and Kiaer on the Arctic and Scandinavian areas, these cover a very large amount of the ocean bottom. Later expeditions, such as that of the Plankton expedition, supplement the work. Of more intensive work that of the Clare Island survey and of the *Goldseeker* about the British

Isles and in the North Sea area the material of which is now being published by Heron-Allen and Earland gives a great deal of new information for an area worked over previously in a more or less incomplete way.

From all these records and especially from the work of Heron-Allen and Earland it is at once clear that there are two general groups of species of foraminifera, those of general distribution and others of very local distribution. The species, such as *Psammosphaera bowmanni* and *P. rustica*, *Technitella thompsoni*, and others are very unique and seem to be rather limited in their distribution. Others, like *Proteonina micacea*, *Girvanella frigida*, and *Hyperammina distorta* are limited also on this side, although this may be due to lack of material connecting the two areas.

The isolation of certain species in Moray Firth at very limited stations seems to show that the species of foraminifera or at least many of them are not universally distributed.

SELECTIVE POWERS OF THE FORAMINIFERA.

With the Astrorhizidae and to a certain extent with the following family, Lituolidae, the material of the test is to a greater or less extent made of foreign material taken from the ocean bottom on which it lives and cemented into a test. When it is considered that this is brought about by a single-celled organism without organs or specially developed sense cells of any sort it is very interesting that a definite selection takes place in the mixed material on which the animal lives on the ocean bottom. That this simple protoplasmic bit has a definite power of selection in the material of its test is very startling. Whether it is a reaction due to chemical stimulation or to tactile reactions in the case of spicules does not seem to be known. As fixed species have accumulated considerable amounts of spicules or other definite fragments it would seem in most cases as though they must have moved about freely and accumulated this material in the protoplasmic body before the test was made.

As of general interest and as the series of selections is subject to a definite gradation it is given here at some length.

CEMENT.

Chitinous.—In *Rhizammina indivisa* there is a basal chitinous layer to which the various foreign particles are attached and the lining is separate from them, persisting even when the surface material is rubbed away. A similar base is found in *Pelosina* and other genera.

Ferruginous.—In the majority of the genera of these two families there is a yellowish or reddish-brown cement which may be used sparingly to cement together the sand grains of the test, as in *Rhabdammina*, or to make the mass of the test in which the sand grain

constituents are inconspicuous as in *Ammodiscus*. This cement gives the characteristic color to many of the species of the family.

Siliceous.—In a few species there seems to be a siliceous cement, as it is unaffected by acids. Many species either secrete or collect fine amorphous siliceous material which is used in the building of the test wall.

SELECTIVE POWER IN THE FORMATION OF THE TEST.

No apparent selection.—A number of species, including those of the genus *Astrorhiza*, simply consolidate more or less firmly the material of the ocean bottom, mud, sand grains, other foraminifera, sponge spicules, etc., indiscriminately into more or less regular tests, the outside usually friable, the inner portion commonly firmer. In such tests as these there seems to be no attempt at any selection, the purpose seeming to be to form a somewhat hard protection to the protoplasmic body.

General selection.—Various groups of the arenaceous foraminifera have some power of selection in that they take some general constituent of the bottom. For instance, *Rhabdammina* usually in its various species uses sand grains or occasionally spicules. This seems to be mainly a case of leaving out one element at the expense of another. Fragments of the harder materials are taken instead of the softer mud or, as in the case of *Crithionina*, taking the finer material and discarding the coarser. As there is no particular power shown in the fitting of these particular groups of material in any definite way except in the matter of the smoothness of finish of the exterior or interior surfaces, the selection can not compare with that which is found in the next group.

Specific selection.—In a few cases the various species seem to have a great power of selection of the material of the test and in the arrangement of the particles which have been selected. The genus *Psammosphaera*, building a generally rounded or irregular test with a single cavity and no definite aperture, has in the various North Atlantic species a great power of specific selection and arrangement.

The common *P. fusca* uses only sand grains, cementing them firmly together, often with a lighter colored cement. Off the coast of the Carolinas specimens are abundant which have taken only black grains, although other colored ones are present as well in the bottom material. The size is not definite and often in smaller specimens the whole of one side will be formed by a single large grain.

P. parva has a habit of building a test of sand grains of much more even size and usually adds to the test a single large acerose sponge spicule which is built into the wall and projects on either side often to a distance as great as the diameter of the test itself. That this is entirely accidental can not be held, for the specimens without

the spicules are few and I have never seen one with a short or broken spicule, but always with a very long uninjured one.

P. testacea builds its test of other foraminifera and lives especially as would be expected in globigerina ooze. The tests are not alike nor of the same size nor shape, but sand grains are almost never used, while in the same dredge haul may be other genera and species largely made up of sand grains.

In *P. bowmanni* there is a selection by which only mica flakes are used, these being cemented together by their edges, making a weak and irregular test. Such specimens, however, rarely show any sand grains and the selective power must be considerable, for in most bottom material the amount of mica flakes is not great.

Lastly, in *P. rustica* is a species with an even greater ingenuity. It uses large acerose spicules for the main lines of its polygonal test, then fills in the sides with broken spicules, fitting each to the polygonal area between the three or more borders of that surface. The long edge spicules are the only ones that extend beyond the face of the wall, the others being fitted as though cut off at the various lengths. The only explanation of the building of such a test as this is that the material is ingested in the protoplasm and then at a certain stage carried to the outside of the protoplasmic body to form the test, and that the distribution of the inner broken spicules is mechanically arranged and the whole cemented.

In the genus *Technitella* there is also a marked selection. *T. melo*, for example, has a rounded test built entirely of sponge spicules, these placed lengthwise of the test and firmly cemented. In *T. legumen*, which is sometimes found with the former species, fine amorphous white material is also used with the spicules and two layers of spicules are distinguished, the inner running transversely and the outer lengthwise. As a result a strong test is developed when the amount of spicules is considerable. In *T. thompsoni* there is a very unique condition in which the test is made up of the disintegrated plates of a brittle star. The amount of these plates in any given area can not be very great, yet the animal obtains sufficient numbers of them to build its test from these entirely, using probably hundreds of individual plates in the process.

SYSTEMATIC TREATMENT.

Order FORAMINIFERA.

Pseudopodia of fine threads, freely anastomosing to form a network; test typically with many minute foramina, in one family with a single aperture; wall of the test composed of chitinous or calcareous material when secreted, or of agglutinated sand, sponge spicules, shells, etc., usually secreting either no silica or a very little under certain conditions.

Family 1. GROMIDAE.

Test usually chitinous, sometimes with a covering of foreign material; apertures one or more; as a rule inhabiting fresh or brackish waters.

As most of the material of this paper is based upon dredged material and has been examined dry little opportunity has been had for obtaining material of this family. Papers by Rhumbler[1] and Calkins[2] may be referred to as having Atlantic data for this family.

Family 2. ASTRORHIZIDAE.

Test composed of agglutinated material for the most part, occasionally with a chitinous inner layer, consisting of a chamber with several openings or a tubular test open at both ends, or in certain forms, of a closed chamber with a single aperture, but throughout the family the test is not divided into a series of chambers.

The species included in this family build tests of agglutinated material, often placed outside a chitinous base as in *Rhizammina*, *Pelosina*, etc. The simplest species, such as found in the genus *Astrorhiza*, simply gather about the soft parts the mud or débris from the bottom and agglutinate it somewhat with a small amount of cement, the central chamber corresponding to the main part of the cell and the arms to the pseudopodia. Next in order are tests with definite openings and later a test closed at but one point, which serves as the aperture, such as *Pelosina*, *Pilulina*, etc., or with several apertures, *Thurammina*. From this the series leads to the species having a definite globular proloculum or initial chamber and a second chamber of greater or less length, *Hyperammina*, *Ammodiscus*, etc.

[1] Arch. Prot., vol. 3, 1903, pp. 181–294.

[2] Marine Protozoa from Woods Hole, Bull. U. S. Fish. Comm., vol. 21, 1900 (1902), pp. 415–468.

Subfamily 1. Astrorhizinae.

Test consisting usually of a tube open at both ends or in some species of *Astrorhiza* with several tubes entering a central chamber; in some species with the tube branching (*Rhabdammina irregularis*, *Rhizammina algaeformis*, etc.).

Included in this subfamily are five genera, *Astrorhiza*, *Rhabdammina*, *Marsipella*, *Bathysiphon*, and *Rhizammina*. With the exception of the first, we know very little concerning the animal, excepting for the material of which the test is made; each consists of a simple or branching tube open at the ends, except in some species of *Astrorhiza*, where there are several tubes and a single central chamber. The growth seems to take place by the addition of material at the open ends of the tube, thus increasing the length. The openings are often variously protected by an accumulation of foreign particles, sponge spicules, etc.

Genus ASTRORHIZA Sandahl, 1857.

Astrorhiza Sandahl (type, *Astrorhiza limicola* Sandahl), Öfv. Svensk. Vet. Akad. Förh., vol. 14, No. 7, 1857, p. 299.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 230.—Flint, Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 265.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 216.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 19.

Astrorhiza+*Rhabdammina* (part) Eimer and Fickert, Zeitschr. wiss. Zool., vol. 65, 1899, p. 666.

Ammodiscus Carpenter and Jeffreys, Proc. Roy. Soc. London, 1870, p. 159 (not *Ammodiscus* Reuss, 1871).

Arenistella Fischer and de Folin, Les Fonds de la Mer, vol. 2, 1872, p. 26.

Astrodiscus F. E. Schulze, II Jahr. Comm. wis. Unt. deutsch. Meer in Kiel, vol. 1, 1875, p. 113.

Haeckelina Bessels, Jen. Zeitschr., vol. 9, 1875, p. 265.

Description.—Test free, flattened or tubular, stellate or subcylindrical, composed of a central chamber with communicating tubular portions to the exterior in the compressed species or of an irregular tubular chamber in the subcylindrical ones; wall composed of sand or mud loosely cemented, often with an inner lining of chitinous material.

Most of the species appear to be characteristic of cool-water conditions, although *A. vermiformis* is a species apparently as far as is known limited to the Gulf of Mexico.

ASTRORHIZA LIMICOLA Sandahl.

Plate 1, figs. 1, 2.

Astrorhiza limicola Sandahl, Ofvers Kongl. Vetenskaps-Akad. Förhandl., vol. 14, 1857, p. 299, pl. 3, figs. 5, 6.—Leidy, Proc. Acad. Nat. Sci. Philadelphia, 1875, p. 65, fig. —P. Fisher, Journ. Zool., vol. 4, 1875, p. 505, pl. 16, figs. 1–4.—Norman, Proc. Roy. Soc. London, vol. 25, 1876, p. 213.—H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 43.—Bütschli, in Bronn, Klassen

und Ordnungen Thier-Reichs, 1880, p. 194, pl. 5, fig. 11.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 231, pl. 19, figs. 1–4.—A. Agassiz, Bull. Mus. Comp. Zoöl., vol. 15, 1888, p. 161, fig. 489.—Woodward, The Observer, vol. 4, 1893, p. 78.—Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 12, pl. 1, figs. 1–3.—Rhumbler, Zeitschr. Allgem. Physiol., vol. 2, 1902, p. 204, fig. 46; Arch. Prot., vol. 3, 1903, p. 217, fig. 36 (in text).—Cushman, Proc. Boston Soc. Nat. Hist., vol. 34, 1908, p. 22.—Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, p. 407, pl. 33, fig. 1.—Cushman, in Sumner, Osburn, and Cole, Bull. Bureau U. S. Fisheries, vol. 31, pt. 2, 1911, p. 549.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 607.

Arenistella elegans (*nomen nudum*) Fisher and Defolin, Les Fonds de la Mer, vol. 2, 1870, p. 26; 1872, vol. 2, p. 52.

Ammodiscus lindahli Carpenter and Jeffreys, Proc. Roy. Soc. London, 1870, p. 159.

Astrodiscus arcuaceus F. E. Schulze, in Jahresb. Komm. wiss. Untersuch. Deutsch Meere, vol. 1, 1875, p. 113, pl. 2, fig. 10.

Haeckelina gigantea Bessels, Jenaische Zeitsch. für nat., vol. 9, 1875, p. 265.

Description.—Test free, compressed, irregularly stellate; composed of a central disk from which horizontal arms radiate horizontally around the peripheral region, variable in length and of irregular form, usually long and slender, often irregularly bifurcating at the tips, 5–15 in number; wall thick, composed of mud with fine sand grains, or in some cases entirely of rather coarse sand grains, interior with a chininous lining, smooth, exteriorly roughened; ends of the arms serving as apertures; wall grayish or yellowish, interior yellowish brown.

Diameter, including arms, up to 15 mm.

Distribution.—From the available records this is a species of shallow waters and for the most part of temperate to cool regions. The following are the Atlantic records: Coast of Bohuslan, Skager-Rack, Sweden (Sandahl, Loven); coast of Norway (Norman); off Heligoland, 21 fathoms (Schulze); off Dunbar (Balfour); west coast of Scotland, 10–20 fathoms (Robertson, Herdman); Northumberland and Durham (Brady); Torbay, Devon (Norman); coast of Connecticut, 25 fathoms, and Maine (Bessels, Verrill); off Block Island; south of Newport and south of Marthas Vineyard (Verrill); Anticosti and Gaspé Peninsula (Woodward); Vineyard Sound, 13 fathoms (Cushman), and off Cape Ann.

Heron-Allen and Earland record a single specimen from the Kerimba Archipelago off the eastern coast of Africa.

From the specimens I have been able to study, the material of the test depends very greatly upon the character of the bottom. The specimens from Gaspé and from the sandy portion of Vineyard Sound have the tests made of coarse quartz sand very largely, and very little mud or fine material is used in their construction.

Astrorhiza limicola—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
.....	B.S.N.H.	10+	.....	Off Cape Ann, Mass.....	.....	.....	.....	.....
.....	B.S.N.H.	3	.....	Vineyard Sound, Mass...	.....	.....	.....	Common.
.....	U.S.N.M.	10+	U.S.F.C. sta. 987 (1881).	Off Marthas Vineyard, Mass.	.....	.....	.....	.....

ASTRORHIZA ARENARIA Norman.

Plate 2, figs. 1–3; plate 3, fig. 1.

Astrorhiza arenaria Norman, Proc. Roy. Soc. London, vol. 25, 1876, p. 213.—H. B. Brady, Quart. Journ. Micr. Sci., vol. 29, 1879, p. 43.—Bütschli, in Bronn, Klassen und Ordungen, Thier-Reichs, 1880, p. 194, pl. 5, fig. 12.—H. B. Brady, Proc. Roy. Soc. Edinburgh, vol. 11, 1882, p. 711; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 232, pl. 19, figs. 5–10.—Goës, Kongl. Svensk. Vet.-Akad. Handlingar, vol. 25, No. 9, 1894, p. 12, pl. 2, figs. 4–10.—Flint, Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 265, pl. 3, fig. 2.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 217, fig. 37 (in text).—Kiaer, in Duc d'Orleans, Croisière Océanographique dans la Mer du Gronland, 1905 (1907), p. 559.—Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, p. 407, pl. 33, fig. 2.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 997.

Astrorhiza limicola M. Sars (*nomen nudum*) (not *A. limicola* Lindahl), Forh. Vid. Selsk. Christiania, 1868, p. 248.—Carpenter, Proc. Roy. Soc. London, vol. 17, 1868, p. 173.—G. O. Sars, Forh. Vid. Selsk. Christiania, 1871 (1872), p. 252.

Astrorhiza, sp., Carpenter, Quart. Journ. Micr. Sci., vol. 16, 1876, p. 221, pl. 19.

Description.—Test compressed, typically with a subcircular mass from which radiate short, stout arms, variable in number, or sometimes elongate with short lateral branches; radiate forms with a rounded central chamber from which the tubular arms are given off; wall thick composed of loosely agglutinated grayish sand, outer surface friable and rough, inner surface smoother and firmer; apertures at the ends of the tubular extensions of the central chamber, usually more or less choked with fine sand grains.

Diameter, up to 15 mm.

Distribution.—Specimens on the European side of the Atlantic are known from the coasts of Norway and Sweden, off Spitzbergen, North Sea and Faroe Channel. On the American side of the Atlantic it is known from Davis Strait, and from three *Albatross* stations given by Flint in the general region off Cape Cod. In the abundant *Albatross* material I have examined, the species has occurred at numerous stations but all in the general region from Nova Scotia southward to Cape Hatteras. These stations range in depth from 82 to 1,631 fathoms, the average being somewhat less than 1,000

fathoms. Bottom temperatures range from 37.3° to 40.6° F. South of this it has not occurred in the material dredged.

Brady records it from off the Cape of Good Hope and Pearcey from two deep water stations in the Antarctic.

Astrorhiza arenaria—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.[1]	Abundance.
			Albatross.	° ′ ″ ° ′ ″		°F.		
9575	U.S.N.M.	6	D2406....	40 02 49 N.; 68 49 00 W.	407	40	b. m.....	Common.
9576	U.S.N.M.	10	D2172....	38 01 15 N.; 73 44 00 W.	565	39	gn. m.....	Few.
9578	U.S.N.M.	10+	D2187....	39 49 30 N.; 71 10 00 W.	420	39.7	gn. m. s.....	Few.
9577	U.S.N.M.	2	D2189....	39 49 30 N.; 70 26 00 W.	600	39.7	gn. m. s.....	Few.
9580	U.S.N.M.	4	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Few.
9579	U.S.N.M.	10+	D2202....	39 38 00 N.; 71 39 45 W.	515	39.1	gn. m.....	Few.
9581	U.S.N.M.	10+	D2213....	39 58 30 N.; 70 30 00 W.	384	39.5	gn. m.....	Common.
9229	U.S.N.M.	1	D2214....	39 57 00 N.; 70 32 00 W.	475	39.5	gn. m.....	Few.
9230	U.S.N.M.	1	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Common.
9231	U.S.N.M.	2	D2237....	39 12 17 N.; 72 09 30 W.	520	39.5	gn. m.....	Few.
9582	U.S.N.M.	5	D2263....	37 08 00 N.; 74 33 00 W.	430	.....	gn. m.....	Few.
9232	U.S.N.M.	1	D2504....	44 23 00 N.; 61 22 45 W.	82	40.6	bk. m. g....	Rare.
9233	U.S.N.M.	10+	D2547....	39 54 30 N.; 70 20 00 W.	390	39.6	gn. m.....	Abundant.
9234	U.S.N.M.	1	D2564....	39 22 00 N.; 71 23 30 W.	1,390	37.3	gy. oz.....	Rare.
9235	U.S.N.M.	10+	D2571....	40 09 30 N.; 67 09 00 W.	1,356	37.8	gy. glob. oz..	Rare.
9236	U.S.N.M.	1	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Rare.
9238	U.S.N.M.	10	D2729....	36 36 00 N.; 74 32 00 W.	679	.....	dk. gn. m...	Rare.
9237	U.S.N.M.	10+	D2731....	36 45 00 N.; 74 28 00 W.	781	.....	gy. oz.....	Rare.
6245	U.S.N.M.	3	Lightning	.....	530	47	.....	

[1] "Character of bottom," determined by the specimens from the sounding cup, is expressed by abbreviations, the key to which is appended. It will be noted that these abbreviations are arbitrarily capitalized for nouns. When used as adjectives, however, the noun abbreviations are not capitalized.

bk.....black
bl.....blue
br.....brown
br-gn.....brownish-green
brk.....broken
C.....Clay
Clmps.....Clumps
Co.....Coral
crs.....coarse
dk.....dark
fne.....fine
For.....Foraminifera
G.....Gravel
Glob.....Globigerina
gn.....green
gn-br.....greenish-brown
gn-gy.....greenish-gray
gy.....gray
hrd.....hard
Lav.....Lava
M.....Mud
mrgn.....marginal
Mss.....Masses
Oz.....ooze
P.....Pebbles
Ptr.....Pteropod
R.....Rock
Rf.....Reef
rky.....rocky
S.....Sand
sctrd.....scattered
Sh.....Shells
sml.....small
Sp.....Specks
St.....Stones
vol.....volcanic
W.....Seaweed
wh.....white

ASTRORHIZA ANGULOSA H. B. Brady.

Plate 3, fig. 2; plate 4, figs. 1–3.

Astrorhiza angulosa H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 48; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 234, pl. 20, figs. 10–13.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 19.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 265, pl. 3, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 218, fig. 38 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 20, fig. 1 (in text).

Description.—Test somewhat compressed, subtriangular or rarely quadrangular, biconvex, broadly rounded at the edges, angles of the test formed by the open ends of tubular portions radiating from a small globular central chamber; wall composed of fine sand, the

outer portion closely cemented and somewhat friable, inner portion firmly cemented, smoothly finished on the interior surface; within, and about the apertures, which are formed by the open ends of the tubular portions, often of a reddish-brown color.

Diameter, up to 5 mm.

Distribution.—Brady in the *Challenger* report records this species from one *Porcupine* station off the British Isles in 630 fathoms and from one Atlantic *Challenger* station, No. 78, in 1,000 fathoms east of the Azores. Flint records it from one *Albatross* station, D2569, in 1,782 fathoms off Marthas Vineyard. In the *Albatross* material I have had from the western Atlantic, it has occurred at 14 stations, but all in the area between Georges Bank off Cape Cod southward toward Cape Hatteras. It has not occurred south of this general region. In depth the records range from 568 to 2,033 fathoms, the average around 1,500 fathoms, bottom temperatures range from 36.8 to 39° F., showing rather cold water distribution, but not occurring in the colder region off the Grand Banks of Newfoundland, where, for instance, *Hyperammina subnodosa* is so very abundant.

Astrorhiza angulosa—*material examined.*

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9569	U.S.N.M.	3	D2038....	38 30 30 N.; 69 08 35 W.	2,033	.....	glob. oz.....	Few.
9570	U.S.N.M.	2	D2042....	39 33 00 N.; 68 26 45 W.	1,555	38.5	glob. oz.....	Few.
9571	U.S.N.M.	4	D2043....	39 49 00 N.; 68 28 30 W.	1,467	38.5	glob. oz.....	Rare.
9572	U.S.N.M.	1	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s....	Rare.
9573	U.S.N.M.	9	D2172....	38 01 15 N.; 73 44 00 W.	568	39	gn. m.....	Few.
9221	U.S.N.M.	10+	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Common.
9222	U.S.N.M.	1	D2228....	37 25 00 N.; 73 06 00 W.	1,582	36.8	br. m.....	Rare.
9223	U.S.N.M.	9	D2229....	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Few.
9224	U.S.N.M.	1	D2564....	39 22 00 N.; 71 23 30 W.	1,390	37.3	gy. oz.....	Rare.
9574	U.S.N.M.	5	D2569....	39 26 00 N.; 68 03 30 W.	1,782	37	gy. oz.....	Few.
9225	U.S.N.M.	1	D2570....	39 54 00 N.; 67 05 30 W.	1,813	36.8	glob. oz.....	Rare.
9226	U.S.N.M.	10+	D2713....	38 20 00 N.; 70 08 30 W.	1,859	.....	br. oz.....	Common.
9227	U.S.N.M.	10+	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz.....	Common.
9228	U.S.N.M.	1	D2729....	36 36 00 N.; 74 32 00 W.	679	.....	dk. gy. m...	Few.

ASTRORHIZA CRASSATINA H. B. Brady.

Astrorhiza crassatina H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 46; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 233, pl. 20, figs. 1–9.—Goës. Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 13, pl. 2, figs. 11–15; Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 19.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 265, pl. 2.—Kiaer, Norske Nordhavs. Exp., No. 25, 1899, p. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 220, fig. 12 (in text). Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 22, fig. 5 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 997.

Rhabdammina crassatina Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 668.

Description.—Test subcylindrical or somewhat irregular, elongate, ends rounded or truncate, with a tubular chamber within, of uneven

diameter, contracted; wall thick, composed of fine sand grains, loosely cemented and friable at the surface, more firmly cemented on the interior, occasionally with a larger pebble at one side or irregularly placed or with other foreign bodies; apertures formed by the open ends of the tubular chambers, often more or less closed by fine sand grains.

Length, up to 10 mm.

Distribution.—In general this is a species of cold waters. It is known from the coast of Norway (M. and G. O. Sars), Kars Fjord, 180 fathoms (Norman); Faroe Channel, 530–650 fathoms (Carpenter, Brady), off the Cape of Good Hope (*Challenger*, Brady); Arctic Sea, off Spitzbergen (Goës), Arctic Ocean (Kiaer), from three *Albatross* stations D2570 off Georges Bank, D2586 off Long Island, and 2723 off Chesapeake Bay, 328–1,813 fathoms (Flint), North Pacific (Cushman), and from the Antarctic, 1,775–2,500 fathoms (Pearcey).

In the Atlantic material I have had the species has occurred at about 20 stations, all northward from Cape Hatteras and ranging northward nearly to the Grand Banks. The depths range from 384 to 2,045 fathoms and the bottom temperatures from 36.8° to 41° F.

Astrorhiza crassatina—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9583	U.S.N.M.	1	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Few.
9584	U.S.N.M.	10+	D2043....	39 49 00 N.; 68 28 30 W.	1,467	38.5	glob. oz.....	Common.
9585	U.S.N.M.	4	D2097....	37 56 20 N.; 70 57 30 W.	1,917	.....	glob. oz.....	Few.
9586	U.S.N.M.	3	D2105....	37 50 00 N.; 73 03 50 W.	1,395	41	glob. oz.....	Few.
9587	U.S.N.M.	1	D2111....	35 09 50 N.; 74 57 40 W.	938	.....	b. m.....	Rare.
9588	U.S.N.M.	2	D2171....	37 59 30 N.; 73 48 40 W.	444	39.5	gn. m.....	Rare.
9589	U.S.N.M.	2	D2172....	38 01 15 N.; 73 44 00 W.	568	39	gn. m.....	Rare.
9590	U.S.N.M.	6	D2174....	38 15 00 N.; 72 03 00 W.	1,594	.....	gy. m.....	Common.
9591	U.S.N.M.	1	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Rare.
9592	U.S.N.M.	1	D2213....	39 58 30 N.; 70 30 00 W.	384	39.5	gn. m.....	Rare.
9239	U.S.N.M.	10	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Common.
9240	U.S.N.M.	1	D2222....	39 03 15 N.; 70 50 45 W.	1,537	36.9	gy. oz.....	Rare.
9241	U.S.N.M.	1	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Rare.
9242	U.S.N.M.	3	D2229....	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Few.
9243	U.S.N.M.	2	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Few.
9244	U.S.N.M.	10	D2564....	39 22 00 N.; 71 23 30 W.	1,390	37.3	gy. m.....	Abundant.
9245	U.S.N.M.	6	D2570....	39 54 00 N.; 67 05 30 W.	1,813	36.8	glob. oz.....	Abundant.
9246	U.S.N.M.	1	D2571....	40 09 30 N.; 67 09 00 W.	1,356	37.8	glob. oz.....	Few.
9247	U.S.N.M.	1	D2706....	41 28 30 N.; 65 35 30 W.	1,188	.....	gy. oz.....	Rare.
9248	U.S.N.M.	3	D2714....	38 22 00 N.; 70 17 30 W.	1,825	.....	br. oz.....	Few.
9249	U.S.N.M.	5	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz.....	Common.
9250	U.S.N.M.	3	D2729....	36 36 00 N.; 74 32 00 W.	679	.....	dk. gn. m....	Few.
6226	U.S.N.M.	2	.....	Faroe Channel.....	640	.....	.....	

ASTRORHIZA GRANULOSA (H. B. Brady.)

Plate 5, fig. 4.

Marsipella granulosa H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 36, pl. 3, figs. 8, 9.—Bütschli, in Bronn's Klassen und Ordnungen des Thierreichs, vol. 1, 1880, p. 194, pl. 5, fig. 9.

Astrorhiza granulosa H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 48; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 234, pl. 20, figs. 14–23.—Neumayr, Stämme Thierreichs, vol. 1, 1889, p. 173, fig. 17*d*.—Goës, Bull.

Mus. Comp. Zoöl., vol. 29, 1896, p. 19.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 265, pl. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 219, fig. 41 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 21, fig. 5 (in text).

Rhabdammina granulosa Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 667.

Description.—Test generally fusiform, tapering toward the ends, internally with a tubular chamber of nearly uniform diameter running the whole length of the test; wall composed of fine sand grains rather loosely cemented at the exterior, but more firmly fixed on the interior and at the ends, where the color is often a reddish brown, interior smoothly finished, exterior often with foreign particles of various sorts imbedded in the walls; apertures formed by the open ends of the tubular chamber, often obscured by a loose filling of fine sand particles.

Length, up to 7 mm.

Distribution.—Brady described *A. granulosa* from a single *Challenger* station, No. 78, in 1,000 fathoms, east of the Azores. It is also known from the Bay of Biscay (Rhumblër); from three *Albatross* stations off the east coast of the United States, in 1,685–1,781 fathoms (Flint). In the Pacific it is known from the eastern portion off Panama, in 1,201 fathoms (Goës), and off Japan (Cushman).

In the *Albatross* Atlantic material I have examined it has been noted at 25 stations, ranging in depth from 390 to 2,045 fathoms, bottom temperatures from 36.8° to 41° F. These stations range from slightly north of Cape Hatteras to Nova Scotia, with no records at all in all the material south of this region.

Astrorhiza granulosa—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9593	U.S.N.M.	1	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Rare.
9594	U.S.N.M.	1	D2038....	38 30 30 N.; 69 08 35 W.	2,033	.....	glob. oz.....	Common.
9595	U.S.N.M.	2	D2042....	39 33 00 N.; 68 23 45 W.	1,555	38.5	glob. oz.....	Few.
9596	U.S.N.M.	10+	D2043....	39 49 00 N.; 68 28 30 W.	1,467	38.5	glob. oz.....	Few.
9597	U.S.N.M.	4	D2046....	40 02 49 N.; 68 49 00 W.	407	40	bu. m.....	Rare.
9598	U.S.N.M.	4	D2084....	40 16 50 N.; 67 05 15 W.	1,290	40	bu. m. s.....	Few.
9599	U.S.N.M.	4	D2105....	37 50 00 N.; 73 03 50 W.	1,395	41	glob. oz.....	Rare.
9600	U.S.N.M.	2	D2111....	35 09 50 N.; 74 57 40 W.	938	.....	gn. m.....	Rare.
9601	U.S.N.M.	2	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s....	Rare.
9602	U.S.N.M.	1	D2172....	38 01 15 N.; 73 44 00 W.	568	39	gn. m.....	Few.
9603	U.S.N.M.	2	D2187....	39 49 30 N.; 71 10 00 W.	420	39.7	gn. m. s.....	Rare.
9604	U.S.N.M.	2	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Few.
9251	U.S.N.M.	10+	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Rare.
9252	U.S.N.M.	3	D2225....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Common.
9253	U.S.N.M.	10+	D2229....	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Few.
9254	U.S.N.M.	2	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Few.
9255	U.S.N.M.	4	D2547....	39 54 30 N.; 70 20 00 W.	390	39.6	gn. m.....	Few.
9256	U.S.N.M.	1	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Rare.
9257	U.S.N.M.	10+	D2564....	39 22 00 N.; 71 23 30 W.	1,390	37.3	gy. oz.....	Common.
9258	U.S.N.M.	8	D2570....	39 54 00 N.; 67 05 30 W.	1,813	36.8	glob. oz.....	Common
9259	U.S.N.M.	2	D2571....	40 09 30 N.; 67 09 00 W.	1,356	37.8	gy. glob. oz.	Few.
9260	U.S.N.M.	6	D2713....	38 20 00 N.; 70 08 30 W.	1,859	.....	br. oz.....	Common.
9261	U.S.N.M.	10+	D2714....	38 22 00 N.; 70 17 30 W.	1,825	.....	br. oz.....	Few.
9262	U.S.N.M.	8	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Common.
9263	U.S.N.M.	3	D2729....	36 36 00 N.; 74 32 00 W.	679	.....	dk. gn. m....	Common.

ASTRORHIZA VERMIFORMIS Goës.

Plate 5, figs. 1–3; plate 6, fig. 6.

Astrorhiza vermiformis Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 20, pl. 1, fig. 9.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 218, fig. 40 (in text).

Description.—Test tubular, usually bent, wall thick, made up of dark grayish mud, before drying more or less flexible; the dried specimens with numerous fine crevices in the wall, usually annular or partially so, apertures at the ends of the tube, which is somewhat tapering, consisting of an unrestricted circular or compressed opening.

Length, 10–13 mm.

Distribution.—Type-specimens from *Albatross* station D2384, Gulf of Mexico, 28° 45′ N., 88° 15′ W., about 58 miles south-southeast from the middle mouth of the Mississippi, in 940 fathoms. I have had material from this station and also from the neighboring one—D2385, Gulf of Mexico, 28° 51′ N., 88° 18′ W., in 730 fathoms.

Astrorhiza vermiformis—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9605	U.S.N.M.	10+	D2384....	28 45 00 N.; 88 15 30 W.	940	39.6	br. gy. m....	Common.
9606	U.S.N.M.	2	D2385....	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Few.

Genus RHABDAMMINA Carpenter, 1869.

Rhabdammina M. Sars, Forh. Selsk. Christiania, 1868, p. 248 (*nomen nudum*).—W. B. Carpenter (type. *R. abyssorum* W. B. Carpenter), Ann. Mag. Nat. Hist., ser. 4, vol. 4, 1869, p. 288; Proc. Roy. Soc. London, vol. 18, 1869, p. 60.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 266.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 261.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 23.

Astrorhiza (*part*)+*Rhizammina* (part) Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 666.

Description.—Test free, either radiate, subcylindrical or branching, wall arenaceous usually rather coarsely finished on the exterior, firmly cemented; open ends of the arms serving as apertures.

From the records this genus seems to be characteristic of cool waters and of deep-sea conditions. The arms are easily broken and specimens are usually incomplete. The species all have a wide distribution.

RHABDAMMINA ABYSSORUM W. B. Carpenter.

Plate 6, fig. 1; plate 7, fig. 1.

Rhabdammina abyssorum M. Sars, Förh. Vid. Selsk. Christiania, 1868, p. 248 (*nomen nudum*).—W. B. Carpenter, Ann. Mag. Nat. Hist., ser. 4, vol. 4, 1869, p. 288; Proc. Roy. Soc. London, vol. 18, 1869, p. 60.—G. O. Sars, Förh. vid. Selsk. Christiania, 1871, pp. 250, 251.—Carpenter, The Microscope, ed. 6, 1881, pp. 562, 563, figs. 321*c*, *d* (in text).—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 266, pl. 21, figs. 1–13.—De Folin, Le Naturaliste, vol. 9, 1887, p. 127, fig. 12*a*.—A. Agassiz, Bull. Mus. Comp. Zoöl., vol. 15, 1888, pp. 162, 163, figs. 492, 493 (in text).—Newmayr, Stämme Thierreichs, vol. 1, 1889, p. 173, fig. 17*a* (in text).—Egger, Abh. Bay. Akad. Wiss. München, vol. 18, 1893, p. 255, pl. 4, fig. 31.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 19, pl. 4, figs. 67, 68.—Schlumberger, Mém. Soc. Zool. France, vol. 7, 1894, p. 254.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 21.—Kiaer, Norske Nordhavs. Exped., No. 25, 1899, p. 4.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 271, pl. 12, fig. 2.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 264, fig. 108 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 24, figs. 8–10 (in text).—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, No. 3, 1911, p. 10.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 998.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 221.

Rhabdammina abyssorum, var. *robusta* Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 19, No. 4, 1882, p. 143, pl. 12, figs. 430, 431.

Astrorhiza abyssorum Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 666.

Description.—Test free, consisting of a central subglobular chamber with typically three radiating arms, varying in number to five, of nearly uniform diameter, with no divisions; when three, usually in the same plane but the accessory arms above this number often added in a different plane; wall of sand grains, firmly cemented, with a reddish brown cement often giving a decided tinge of color to the whole test, interior fairly smooth and reddish from the color of the cement, exterior roughly finished; apertures formed by the circular openings at the ends of the tubular arms.

Length of test with the arms, up to 20 mm.

Distribution.—In colder waters this is a very widely distributed species. It is recorded from the Arctic off Greenland, Norway, and to the north of Siberia about Great Britain, Baffins Bay, Gulf of Mexico, and the Caribbean Sea. On the western coast of the Atlantic it has occurred frequently in the *Albatross* material. In the long list the stations range in depth from 82 to 2,045 fathoms and the bottom temperatures from 36.8° to 41° F., with a single station in the Gulf of Mexico 51.6° at 196 fathoms.

The best development of the species is in the colder water from Cape Hatteras northward to the Newfoundland Banks.

The following variety is distinguished:

Rhabdammina abyssorum—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9783	U.S.N.M.	10+	D2003....	37 16 30 N.; 74 20 36 W.	641	.....	.....	Common.
9784	U.S.N.M.	5	D2035....	39 26 16 N.; 70 02 37 W.	1,362	.....	glob. oz.....	Few.
9785	U.S.N.M.	10+	D2046....	40 02 49 N.; 68 49 00 W.	407	40	bu. m.....	Common.
9786	U.S.N.M.	4	D2048....	40 02 00 N.; 68 50 30 W.	547	39	crs. m. g....	Few.
9787	U.S.N.M.	5	D2072....	41 53 00 N.; 65 35 00 W.	858	39	gy. m.....	Few.
9788	U.S.N.M.	3	D2097....	37 56 20 N.; 70 51 30 W.	1,917	.....	glob. oz.....	Few.
9789	U.S.N.M.	1	D2105....	37 50 00 N.; 73 03 50 W.	1,395	41	glob. oz.....	Rare.
9790	U.S.N.M.	1	D2110....	35 12 10 N.; 74 57 15 W.	516	40	bu. m.....	Rare.
9791	U.S.N.M.	2	D2111....	35 09 50 N.; 74 57 40 W.	938	.....	gn. m.....	Few.
9792	U.S.N.M.	3	D2171....	37 59 30 N.; 73 48 40 W.	444	39.5	gn. m.	Few.
9793	U.S.N.M.	6	D2172....	38 01 15 N.; 73 44 00 W.	568	39	gn. m.....	Few.
9794	U.S.N.M.	10	D2187....	39 49 30 N.; 71 10 00 W.	420	39.7	gn. m. s.....	Common.
9795	U.S.N.M.	1	D2189....	39 49 30 N.; 70 26 00 W.	600	39.7	gn. m. s.....	Few.
9449	U.S.N.M.	10+	D2214....	39 57 00 N.; 70 32 00 W.	475	39.5	gn. m.....	Common.
9450	U.S.N.M.	1	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Few.
9451	U.S.N.M.	1	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Few.
9453	U.S.N.M.	1	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Few.
9452	U.S.N.M.	8	D2237....	39 12 17 N.; 72 09 30 W.	520	39.5	gn. m.....	Common.
9796	U.S.N.M.	9	D2383....	28 32 00 N.; 88 06 00 W.	1,181	39.8	br. gn. m....	Common.
9454	U.S.N.M.	2	D2399....	28 44 00 N.; 86 18 00 W.	196	51.6	gy. m.....	Few.
9455	U.S.N.M.	10	D2504....	44 23 00 N.; 61 22 45 W.	82	40.6	bk. m. g.....	Common.
9456	U.S.N.M.	10+	D2547....	39 54 30 N.; 70 20 00 W.	390	39.6	gn. m.....	Common.
9457	U.S.N.M.	6	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Common.
9458	U.S.N.M.	4	D2552....	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.....	Few.
9459	U.S.N.M.	7	D2584....	39 05 30 N.; 72 23 20 W.	541	39.5	gy. m.....	Few.
9797	U.S.N.M.	2	D2678....	32 40 00 N.; 76 40 30 W.	731	38.7	lt. gy. oz....	Few.
9460	U.S.N.M.	10+	D2680....	39 50 00 N.; 70 26 00 W.	555	.....	No specimen	Common.
9461	U.S.N.M.	2	D2696....	46 53 30 N.; 45 05 30 W.	98	.....	gy.s.bk.sp..	Few.
9462	U.S.N.M.	8	D2697....	47 40 00 N.; 47 35 30 W.	206	.....	gn. m. bk.sp	Common.
9463	U.S.N.M.	5	D2714....	38 32 00 N.; 70 17 30 W.	1,826	.....	br. oz.....	Few.
9464	U.S.N.M.	1	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Rare.
9465	U.S.N.M.	1	D2731....	36 45 00 N.; 74 28 00 W.	781	.....	gy. oz.....	Rare.

RHABDAMMINA ABYSSORUM W. B. Carpenter, var. RADIATA Cushman.

Rhabdammina abyssorum W. B. Carpenter, var. *radiata* Cushman, Proc. U. S. Nat. Mus., vol. 51, 1917, p. 652.

Description.—Test with a globular central chamber from which radiate numerous arms with annular constrictions, largest diameter of the arms near the central chamber, thence tapering toward the outer end; wall of fine texture, smoother than the typical, reddish brown in color.

Distribution.—Although comparatively rare in the Atlantic, specimens of this variety were found in material from two *Albatross* stations, D2383, 1,181 fathoms, bottom temperature 39.8° F., and D2385, 730 fathoms, bottom temperature 40.1° F. These stations are both in the northern part of the Gulf of Mexico.

The types were described from *Albatross* station D5654 in 805 fathoms from the Gulf of Boni. In the deep water of the East Indian region of the Pacific this variety is met with in considerable numbers, replacing the typical form but in the Atlantic it is apparently rare.

Rhabdammina abyssorum, var. radiata—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9798	U.S.N.M.	4	D2383....	28 32 00 N.; 88 06 00 W.	1,181	39.8	br. gn. m....	Few.
9798	U.S.N.M.	3	D2385....	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Few.
9466	U.S.N.M.	1	H53.....	17 45 20 N.; 65 35 35 W.	1,345	.....	oz. for.....	Rare.

RHABDAMMINA IRREGULARIS W. B. Carpenter.

Plate 8, fig. 1.

Rhabdammina irregularis W. B. Carpenter, Proc. Roy. Soc. London, vol. 18, 1869, p. 60.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 268, pl. 21, fig. 9.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 21.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 263, fig. 106 (in text).—Cushman. Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 26, figs. 11, 12 (in text).

Description.—Test made up of a dichotomously branching tubular chamber, of nearly uniform diameter; wall of firmly cemented sand grains, exterior rather rough, interior smoothly finished; ends of the tubes serving as apertures; color usually a yellowish or reddish brown.

Length, up to 37.5 mm.

Distribution.—Very little is known of the distribution of this species in the Atlantic. It was described by Carpenter from material dredged on the *Lightning* expedition and is also recorded from the Bay of Biscay from *Le Travailleur* dredgings by Norman and appearing in the *Challenger* report as a note by Brady as follows: "I am informed by the Rev. A. M. Norman that a variety with branching arms was also obtained in the dredging operations of *Le Travailleur* in the Bay of Biscay, in 1880."

In the Pacific in various places, especialy in the region along the western coast of America northward to the Gulf of California it is often very abundant and again in some parts of the deep water of the East Indian region.

As I have already mentioned, in the Pacific material there seems to be some doubt as to the complete form of this species as all material appears to be but fragmentary and broken, the line of weakness seeming to come just above the point of branching.

RHABDAMMINA CORNUTA H. B. Brady.

Plate 6, figs. 2–5.

Astrorhiza cornuta H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 43, pl. 4, figs. 14, 15.

Rhabdammina cornuta H. B. Brady, Proc. Roy. Soc. Edinburgh, vol. 11, 1882, p. 714; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 270, pl. 22, figs. 11–13.—Flint, Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 271, pl. 14, fig. 2.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 264, fig. 107 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 998.

Rhizammina cornuta Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 667.

Description.—Test free, typically consisting of a central inflated, subspherical or irregular body with numerous short arms radiating from various points of the surface, sometimes irregular and elongate, irregularly branching; wall thin, composed of a single layer of rather coarse sand grains with a brownish cement, firmly joined, exterior irregular, arms in the subglobular form usually ending in single circular orifices; those of the elongate form usually with one or more chitinous tubes, bifurcating at the tip.

Length of the elongate form, up to 6 mm.; the diameter of the subglobular form rarely exceeding 1.5 mm.

Distribution.—Brady records this species from four Atlantic stations, south of the Rockall Bank, 1,215 fathoms; off the west coast of Ireland, 816 fathoms; from the warm area of the Faroe Channel, 532 fathoms, and southeast of Pernambuco, Brazil, 350 fathoms. Flint records it from the east coast of the United States and from near old Providence Island in the Caribbean. I have noted it from 12 stations in the *Albatross* material from the region of Georges Banks to Cape Hatteras, stations ranging in depth from 515 to 2,045 fathoms and bottom temperatures from 34.4° to 39.7° with a single station 45° F.

Practically all the material off the shores of the United States is the subglobular form with the short radiating arms figured by Flint from the same region. The elongate form may prove to be a different species, as it has very different characters in the bifurcating arms, etc. I have not, however, had an opportunity to study any except dried material and in this the arms are lacking.

Rhabdammina cornuta—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9801	U.S.N.M.	3	D2052....	39 40 05 N.; 69 21 25 W.	1,098	45	glob. oz.....	Few.
9800	U.S.N.M.	10+	D2072....	41 53 00 N.; 65 35 00 W.	858	39	gn. m.....	Common.
9802	U.S.N.M.	10+	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s....	Common.
9803	U.S.N.M.	2	D2189....	39 49 30 N.; 70 26 00 W.	600	39.7	gn. m. s.....	Few.
9804	U.S.N.M.	10+	D2202....	39 38 00 N.; 71 39 45 W.	515	39.1	gn. m.....	Few.
9805	U.S.N.M.	2	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Rare.
9444	U.S.N.M.	6	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Rare.
9490	U.S.N.M.	10+	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Few.
9445	U.S.N.M.	2	D2531....	40 42 00 N.; 66 33 00 W.	852	34.4	gy. m.....	Rare.
9446	U.S.N.M.	5	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Rare.
9447	U.S.N.M.	1	D2552....	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.....	Rare.
9448	U.S.N.M.	1	D2682....	39 38 00 N.; 70 22 00 W.	1,004	.....	gn. m. s.....	Rare.

RHABDAMMINA CORNUTA H. B. Brady, var. SPICULOTESTA, new variety.

Description.—Test differing from the typical form in the material used in the construction of the test, sponge spicules being used almost exclusively, the shape of the body and the angles of the arms being largely determined by this fact, the spicules being unadapted to a curved surface.

Distribution.—Type-specimens from *Albatross* station D2150 in 382 fathoms in the Caribbean Sea (13° 34′ 45″ N.; 81° 21′ 10″ W.), bottom temperature 45.75° F.: bottom given as white coarse sand.

Superficially this variety suggests the figures of *Psammosphaera rustica* due to the similarity in the contour of the test produced by the inflexibility in the use of the larger spicules. The arms likewise are modified and instead of curving bends in them they are very much angled and very awkward appearing. Almost no sand grains are used in the test of the specimens from this station, although other arenaceous species from the same dredging seem to be normal in this particular.

Rhabdammina cornuta, var. spiculotesta—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
98094	U.S.N.M.	10+	D2150....	° ′ ″ ° ′ ″ 13 34 45 N.; 81 21 10 W.	382	°F. 45.75	wh. crs. s....	Common.

RHABDAMMINA LINEARIS H. B. Brady.

Plate 7, figs. 2–5.

Rhabdammina linearis H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 37, pl. 3, figs. 10, 11.—Bütschli, in Bronn, Klassen und Ordnungen der Thierreichs, vol. 1, 1880, p. 194, pl. 5, fig. 10.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 269, pl. 22, figs. 1–6.—A. Agassiz, Bull. Mus. Comp. Zoöl., vol. 15, 1888, p. 163, fig. 494 (in text).—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 18, pl. 4, figs. 65, 66.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 271, pl. 14, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 232, fig. 104 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 28, figs. 14*af* (in text).

Description.—Test free, elongate, straight or irregularly bent, consisting of a central, subglobular chamber from which cylindrical arms extend in opposite directions, giving the appearance of a cylindrical tube swollen in the middle; wall composed of sand grains firmly cemented, that of the central chamber less thick than that of the arms; rather smoothly finished both within and without; aperture formed by the open ends of the tubes; color variable according to the material used in building the test.

Length, up to 10 mm.

Distribution.—The following stations are given by Brady in the *Challenger* report, Hardinger Fiord, Norway, 126 fathoms; west coast of Ireland, 816 fathoms; off Sombrero Island, West Indies, 450 fathoms; off Culebra Island, West Indies, 390 fathoms; off Pernambuco, Brazil, 675 fathoms; and east of Buenos Aires, 1,900 fathoms. Goës records it off Greenland in 100 meters and from the Caribbean Sea, 211

to 940 fathoms. Flint gives two *Albatross* stations, D2570 in 1,813 fathoms, southeast of Georges Banks and D2760 in 1,019 fathoms, off Bâhia, Brazil.

In my study of the material from the North Pacific it was found to be extremely rare, the two stations of the *Challenger* from off Japan and in the deeper portion of the Pacific being its only records.

It is pleasureable, therefore, to examine the *Albatross* material from the Western Atlantic and find that this hitherto comparatively rare species occurs very generally and often in considerable numbers. I have made records of its occurrence at 33 stations. There are two forms which may be noted although perhaps not worthy of varietal rank. One is more or less robust with the whole test nearly straight, the other much more slender and the whole test often very irregularly bent. These latter seem to be more characteristic of warmer waters, the depths range from 196 to 2,045 fathoms and bottom temperatures from 36.8° to 51.6° F., the latter being at the shallowest station in the Gulf of Mexico. The species is most common in material from Georges Bank southward to Cape Hatteras but occurs in the Gulf of Mexico and the Caribbean Sea.

Rhabdammina linearis—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9817	U.S.N.M.	1	D2035....	39 26 16 N.; 70 02 37 W.	1,362	.....	glob. oz.....	Rare.
9818	U.S.N.M.	10+	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Common.
9819	U.S.N.M.	3	D2038....	38 50 30 N.; 69 08 35 W.	2,033	.....	glob. oz.....	Few.
9820	U.S.N.M.	6	D2041....	39 22 50 N.; 68 25 00 W.	1,608	38	glob. oz.....	Few.
9821	U.S.N.M.	2	D2042....	39 33 00 N.; 68 26 45 W.	1,555	38.5	glob. oz.....	Few.
9822	U.S.N.M.	4	D2043....	39 49 00 N.; 68 28 30 W.	1,467	38.5	glob. oz.....	Few.
9835	U.S.N.M.	1	D2072....	41 53 00 N.; 65 35 00 W.	858	39	gy. m.....	Rare.
9823	U.S.N.M.	8	D2097....	37 56 20 N.; 70 57 30 W.	1,917	.....	glob. oz.....	Common.
9824	U.S.N.M.	1	D2105....	37 50 00 N.; 73 03 50 W.	1,395	41	glob. oz.....	Rare.
9825	U.S.N.M.	3	D2106....	37 41 20 N.; 73 03 20 W.	1,497	42.5	glob. oz.....	Few.
9826	U.S.N.M.	1	D2111....	35 09 50 N.; 74 57 49 W.	938	.....	gn. m.....	Rare.
9827	U.S.N.M.	3	D2116....	35 45 23 N.; 74 31 25 W.	888	39	bu. mfne. s..	Few.
9828	U.S.N.M.	2	D2150....	13 31 45 N.; 81 21 10 W.	382	45.75	wh. crs. s....	Few.
9829	U.S.N.M.	6	D2174....	38 15 00 N.; 72 03 00 W.	1,594	.....	gy. m.....	Few.
9830	U.S.N.M.	1	D2206....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Rare.
9467	U.S.N.M.	9	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Common.
9468	U.S.N.M.	2	D2222....	34 03 15 N.; 70 50 45 W.	1,537	36.9	gy. oz.....	Few.
9469	U.S.N.M.	7	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Few.
9470	U.S.N.M.	1	D2228....	37 25 00 N.; 73 06 00 W.	1,582	36.8	br. m.....	Rare.
9471	U.S.N.M.	2	D2229....	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Few.
9831	U.S.N.M.	1	D2383....	28 32 00 N.; 88 06 00 W.	1,181	39.8	br. gn. m.	Few.
9832	U.S.N.M.	3	D2385....	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Few.
9833	U.S.N.M.	1	D2398....	28 45 00 N.; 86 26 00 W.	227	48.6	gy. m.....	Rare.
9472	U.S.N.M.	1	D2399....	28 44 00 N.; 86 18 00 W.	196	51.6	gy. m.....	Rare.
9473	U.S.N.M.	1	D2562....	39 15 30 N.; 71 25 00 W.	1,431	37.3	gy. oz.....	Rare.
9474	U.S.N.M.	3	D2564....	39 22 00 N.; 71 23 30 W.	1,390	37.3	gy. oz.....	Few.
9475	U.S.N.M.	2	D2570....	39 54 00 N.; 67 05 30 W.	1,813	36.8	glob. oz.....	Few.
9834	U.S.N.M.	4	D2643....	25 25 00 N.; 79 55 15 W.	211	43.1	gy. s.....	Few.
9476	U.S.N.M.	2	D2713....	38 20 00 N.; 70 08 30 W.	1,859	.....	br. oz.....	Few.
9477	U.S.N.M.	1	D2714....	38 22 00 N.; 70 17 30 W.	1,825	.....	br. oz.....	Rare.
9478	U.S.N.M.	5	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Few.
9479	U.S.N.M.	2	D2751....	16 54 00 N.; 63 12 00 W.	687	40	br. glob. oz..	Few.
9480	U.S.N.M.	3	H58.....	17 45 20 N.; 65 35 35 W.	1,345	.....	oz. for.....	Rare.

RHABDAMMINA DISCRETA H. B. Brady.

Plate 11, fig. 1.

Rhabdopleura species G. M. Dawson, Can. Nat., vol. 5, 1870, p. 177, fig. 7.

Rhabdopleura abyssorum G. M. Dawson, Amer. Journ. Sci., vol. 1, 1871, p. 205, fig. 7; Ann. Mag. Nat. Hist., ser. 4, vol. 7, 1871, p. 86, fig. 7.

Rhabdammina discreta H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 48; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 268, pl. 22, figs. 11–13.—Chapman, Proc. Zool. Soc. London, 1895, p. 14.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 21, pl. 1, figs. 13, 14.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 271, pl. 13.—Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 668.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 263, fig 105 (in text).—Bagg, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 125.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 27, fig. 13 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 998.

Description.—Test free, straight, cylindrical, constricted somewhat at irregular intervals exteriorly, but the chamber within of nearly uniform diameter throughout; wall composed of sand grains firmly cemented, exteriorly rough but the interior rather smoothly finished; open ends of the tube serving as apertures; color variable, depending upon the material used in the construction of the test.

Length, indefinite, up to 25 mm.

Distribution.—It has been thought that this species is rather characteristic of cold water. It is found off Greenland from 350 to 1,000 meters (Goës) and Brady records it from the same region in 20 fathoms. Pearcey records it as typical and in plenty in 2,620 and 2,700 fathoms in the Antarctic. Flint records it from the western Atlantic, *Albatross* D2731, in 781 fathoms off Chesapeake Bay.

In the *Albatross* material I have been able to examine it has occurred from the latitude of Georges Banks southward along the coast, in the Gulf of Mexico, the Carribbean Sea, and off the coast of South America. Depths range from 410 to 2,045 fathoms and bottom temperatures from 35.7° to 45.75° F.

It is worth noting that it is lacking in the material I have examined from the very cold water north of the Nowfoundland Banks, and Awerinzew does not record it in his paper in the Siberian material. It therefore is probably not as much limited to cold temperatures as has been supposed.

Specimens always give the impression that they are broken and incomplete as though they were but the arms of some larger arenaceous form that is broken in dredging but this may be only suggestive.

Rhabdammina discreta—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9807	U.S.N.M.	1	D2035....	39 26 16 N.; 70 02 37 W.	1,362	.....	glob. oz.....	Few.
9808	U.S.N.M.	7	D2115....	15 49 20 N.; 74 34 45 W.	843	39	m. fne. s....	Few.
9809	U.S.N.M.	1	D2140....	17 36 10 N.; 76 46 05 W.	966	39.7	S.....	Rare.
9810	U.S.N.M.	1	D2203....	39 34 15 N.; 71 11 15 W.	705	38.9	gn. m. s.....	Few.
9481	U.S.N.M.	1	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Few.
9811	U.S.N.M.	10+	D2383....	28 32 00 N.; 88 06 00 W.	1,181	39.8	br. gn. m....	Common.
9812	U.S.N.M.	6	D2384 ...	28 45 00 N.; 88 15 30 W.	940	39.6	br. gy. m....	Common.
9813	U.S.N.M.	8	D2385....	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Common.
9814	U.S.N.M.	1	D2678....	32 40 00 N.; 76 40 30 W.	731	35.7	lt. gy. oz....	Few.
9482	U.S.N.M.	3	D2714....	38 22 00 N.; 70 17 30 W.	1,825	.....	br. oz.....	Few.
9483	U.S.N.M.	1	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Rare.
9484	U.S.N.M.	10+	D2729....	36 36 00 N.; 74 32 00 W.	679	.....	dk. gy. m....	Common
9485	U.S.N.M.	3	D2731....	36 45 00 N.; 74 28 00 W.	781	.....	gy. oz.....	Common
9486	U.S.N.M.	2	D2751....	16 54 00 N.; 63 12 00 W.	687	40	bu. glob. oz..	Few.
9487	U.S.N.M.	10+	H58.....	17 45 20 N.; 65 35 35 W.	1,345	.....	oz. for.....	Common.
9488	U.S.N.M.	1	H79.....	14 20 30 N.; 63 10 00 W.	821	.....	w. s. sh. for..	Rare.
9489	U.S.N.M.	2	H86.....	12 58 40 N.; 62 48 00 W.	1,635	.....	bu. m. for bk. sh.	Rare.
6266	U.S.N.M.	.....	Valorous No. 6.	.....	410	.....	.....	

RHABDAMMINA DISCRETA H. B. Brady, var. SPICULOSA, new variety.

Description.—Test different from the typical in the construction of the test which in the variety is composed almost wholly of fragments of sponge spicules, the other characters such as the constrictions of the wall being typical.

Distribution.—Type-specimens from *Albatross* station D2150 in 382 fathoms in the Caribbean Sea (13° 34′ 45″ N.; 81° 21′ 10″ W.) bottom temperature 45.75° F.: bottom given in the record as white, coarse sand.

Although the main material of the test is spicules, the characteristic reddish brown cement is used and the test as a whole has the appearance of typical specimens except for the smoothness of the exterior until a close examination is made. Instead of long acerose spicules being used, as is the case with the variety of *R. cornuta* obtained from this station, the spicules are all short and broken.

Rhabdammina discreta, var. spiculosa—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9816	U.S.N.M.	10+	D2150....	13 34 45 N.; 81 21 10 W.	382	45.75	wh. ers. s...	Common.

Genus MARSIPELLA Norman, 1878.

Proteonina W. B. Carpenter, Proc. Roy. Soc. London, vol. 18, 1869, p. 60 (not *Proteonina* Williamson, 1858).

Marsipella Norman (type, *M. elongata* Norman), Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 281.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 264.—Eimer and Fickert (part), Zeitschr. Wiss. Zool., vol. 65, 1899, p. 668.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 265.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 29.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1912, p. 388.—Rhumbler, Plankton Exped., Foraminiferen, pt. 2, 1913, p. 382.

Description.—Test free, tubular, cylindrical or fusiform, sometimes recurved at the ends, wall composed wholly or in part of sponge spicules, or in part of sand grains, thin, firmly cemented; aperture formed by the open ends of the tube or in some cases closed anteriorly by a loosely aggregated knob of spicules.

The discovery by Heron-Allen and Earland in *M. cylindrica* of definite apertured "head" with a bulbous mass of sponge spicules gives rise to the question as to the completeness of many of our dredged specimens. The description of the genus is modified very nearly as suggested by Heron-Allen and Earland in their paper.[1]

MARSIPELLA ELONGATA Norman.

Plate 8, figs. 2, 3.

Proteonina, species, W. B. Carpenter, Proc. Roy. Soc. London, vol. 18, 1869, p. 60.

Marsipella elongata Norman, Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 281, pl. 16, fig. 7.—Carpenter, The Microscope, ed. 6, 1881, p. 561, figs. 320*d-f*.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 265, pl. 24, figs. 10–19.—Chapman, Proc. Zool. Soc. London, 1895, p. 13.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 270, pl. 12, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 265, fig. 110 (in text); Plankton Exped., Foraminiferen, pt. 1, 1909 (1911), pl. 2, fig. 21; pt. 2, 1913, p. 382.

Description.—Test elongate, somewhat fusiform, irregularly curved, thickest in the central portion and gradually tapering toward the ends walls composed of sponge spicules with the central thicker portion covered with sand grains, spicules almost exclusively forming the ends of the tubes, laid together lengthwise and cemented firmly in place; aperture at the ends of the tube.

Length, up to 8 mm.

Distribution.—Brady recorded this species from the Faroe Channel, 440 to 542 fathoms, on Rockall Bank, 54 fathoms and southward 630 fathoms; west of Valentia, off southwest Ireland, 808 fathoms; off Gomera, Canary Islands, 620 fathoms; off the Azores, 900 fathoms; and off Pernambuco, Brazil, 350 fathoms. Flint records it from three *Albatross* stations, D2150, in 382 fathoms near Old Providence Island, Caribbean Sea; D2383, in 1,181 fathoms northern portion of the Gulf

[1] Journ. Roy. Micr. Soc., 1912, p. 388.

of Mexico; and D2677, in 478 fathoms off Cape Fear. Rhumbler records it from off the Hebrides.

In the *Albatross* material I have examined it has occurred at D2150, the station recorded by Flint and at 10 stations along the coast from the Georges Banks to the Virginia Capes, depths ranging from 428 to 1,608 fathoms and bottom temperatures from 34.4° to 40° F.

Marsipella elongata—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9716	U.S.N.M.	3	D2018....	37 12 32 N.; 74 20 04 W.	788	39	bu. m.....	Rare.
9717	U.S.N.M.	1	D2041....	39 22 50 N.; 68 25 00 W.	1,608	38	glob. oz.....	Rare.
9718	U.S.N.M.	1	D2072....	41 53 00 N.; 65 35 00 W.	858	39	gy. m.....	Rare.
9719	U.S.N.M.	1	D2150....	13 34 45 N.; 81 21 10 W.	382	45.75	wh. crs. s....	Rare.
9720	U.S.N.M.	1	D2204....	39 30 30 N.; 71 44 30 W.	728	39.1	br. m.....	Rare.
9721	U.S.N.M.	1	D2205....	39 35 00 N.; 71 18 45 W.	1,073	38.1	gy. oz.....	Rare.
9722	U.S.N.M.	2	D2212....	39 59 20 N.; 70 30 45 W.	428	40	gn. m.....	Rare.
9365	U.S.N.M.	1	D2222....	39 03 15 N.; 70 50 45 W.	1,537	36.9	gy. oz.....	Rare.
9366	U.S.N.M.	3	D2531....	40 42 00 N.; 66 33 00 W.	852	34.4	gy. m.....	Rare.
9367	U.S.N.M.	6	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Rare.
9368	U.S.N.M.	1	D2562....	39 15 30 N.; 71 25 00 W.	1,434	37.3	gy. oz.....	Rare.
6258	U.S.N.M.	10	Porcupine 47.	.....	540	.....	.....	

MARSIPELLA CYLINDRICA H. B. Brady.

Plate 8, figs. 4–6; plate 9, figs. 8, 9.

Marsipella cylindrica H. B. Brady, Proc. Roy. Soc. Edinburgh, vol. 11, 1882, p. 714; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 265, pl. 24, figs. 20–22.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 265, fig. 109 (in text).—Goddard and Jensen, Proc. Linn. Soc. N. S. Wales, vol. 32, 1908, p. 301.—Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, pl. 35, fig. 11.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 30, figs. 15, 16 (in text).—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1912, p. 388, pl. 5, figs. 8, 9; pl. 6, figs. 8, 9.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 999.—Chapman, Zool. Results *Endeavour*, vol. 3, pt. 1, 1915, p. 13, pl. 1, fig. 4.

Description.—Test subcylindrical or slightly fusiform, the exterior or apertural end more or less club shaped; wall composed of elongate sponge spicules, cemented together in various ways either side by side or more often somewhat irregularly or even interlacing, apertural end with a mass of loosely felted spicules from which a few larger spicules radiate, two or three times the diameter of the tubular portion.

Diameter of tubular portion, up to 0.35 mm.; length, up to 12–15 mm.

Distribution.—There are but few records for this species but they are very widely scattered in all the great ocean basins. It is recorded from Faroe Channel by Brady and off Buenos Aires in the *Challenger* dredgings and Heron-Allen and Earland record it from the North Sea. The only material I have had is from the Caribbean Sea, two stations and two others off our eastern Atlantic coast.

The material discovered by Earland in the North Sea is very interesting as giving much new data in regard to the structure of this species. They[1] are quoted at length in the following paragraphs:

This species was described and figured by Brady from species dredged by the *Knight Errant* in the warmer area of the Faroe Channel, 530–542 fathoms. He described his species as tubes of tolerably even diameter rarely exceeding one-fourth inch in length and varying from one two-hundredth to one one-hundredth inch in breadth, manifestly only portions of an organism that might be continued almost indefinitely.

The species is abundant in most of the deep-water dredgings made by the *Goldseeker* in the Faroe Channel and also at Station IX in the North Sea. But when dredging to the west of St. Kilda in 1910 Earland discovered the perfect organism, which we take the present opportunity of figuring.

As figured by Brady the tube of *M. cylindrica* is open at both ends, but in perfect specimens the oral extremity terminates in a club-shaped head of *loosely aggregated* sponge spicules, from which a number of long spicules 0.5–0.8 mm. in length radiate in all directions. The club-shaped head is from two to three times the diameter of the tube; the tube often reaches over one-half inch in length.

The spicules forming the knob are not cemented together or to the tube, but are merely felted together and are easily broken down. This no doubt explains why the test is so seldom found in a perfect condition. It is very probable that other Foraminifera may present a similar terminal appendage when living.

The purpose of the club-shaped head or knob is not very apparent, but probably it serves two purposes. The aggregation of loose spicules closing the mouth of the tube will prevent the ingress of worms and other predatory animals, while the longer spicules may serve the double purpose of defensive spines and "stays" to support the radiating pseudopodia in their quest for food. As the tube grows in length the spicules are absorbed and built into the wall of the tube, other spicules being collected to serve in their place.

Marsipella cylindrica, although a neat builder, does not show the skill and constructive ingenuity of its relative, *M. spiralis*. Sponge spicules enter largely but not entirely into its construction, being mixed indiscriminately with some sand grains, mica, etc., in varying proportions. Individual specimens vary greatly in the neatness of their construction, some showing a slight tendency toward a spiral arrangement of the fragments. We figure one fragment in which this spiral twist is strikingly manifest. The absence of the cement which characterizes *M. spiralis* proves that the fragment should be referred to *M. cylindrica* and not to *M. spiralis*. Moreover the spiral is right-handed.

The question might arise whether the presence of the terminal club-shaped head in *M. cylindrica* does not necessitate the transference of the species to a separate genus. In view of the fact that the terminal portion is so loosely constructed that it can not be said to *close* the tube, we see no reason at present for the transfer of the species. We would, however, suggest that Norman's definition of his genus *Marsipella*, now quoted,[2] should be amplified by the inclusion of the words we have inserted in italics.

Genus MARSIPELLA, n. g.

μάρσιπος (a purse.)

Test elongated, fusiform (or *cylindrical*) centrally cylindrical and drawn out to gradually attenuated extremities, open at both ends [*or closed anteriorly by a loosely aggregated knob of spicules*] monothalamous; anterior extremity much produced into

[1] Heron-Allen and Earland, Journ.Roy.Micr.Soc.,1912,p.388,pl.5,figs.8,9; pl.6,figs.8,9.

[2] Norman, A. M., "On the genus *Haliphysemag*, with description of several forms apparently allied to it." Ann. Mag. Nat. Hist., ser. 5, vol. 1, p. 281.

a narrow contracted mouth-opening. Extraneous matter of body wall consisting for the most part of sand grains, but at the oral extremity composed almost solely of fragments of sponge spicules longitudinally arranged.

Marsipella cylindrica—*material examined.*

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9714	U.S.N.M.	1	D2150....	13 34 45 N.; 81 21 10 W.	382	45.75	wh. crs. s....	Rare.
9715	U.S.N.M.	1	D2204....	39 30 30 N.; 71 44 30 W.	728	39.1	br. m.....	Rare.
9363	U.S.N.M.	1	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Rare.
9364	U.S.N.M.	1	H80.....	13 56 35 N.; 63 02 00 W.	684	.....	gy. m. for...	Rare.
6257	U.S.N.M.	10+	Lightning	.....	650	46	.....	

MARSIPELLA SPIRALIS Heron-Allen and Earland.

Plate 9, fig. 7; plate 10, figs. 6, 7.

Marsipella spiralis Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1912, p. 387, pl. 5, fig. 7; pl. 6, figs. 6, 7.

The original description is as follows:

Test free, monothalamous, consisting of an undivided tube, which is built up of minute fragments of sponge spicules embedded in a light-gray cement, and arranged transversely to the long axis of the tube. The spicules are built in a single layer, and have a distinctly spiral arrangement when the specimen is examined either as an opaque object or in a balsam mount. Viewed as an opaque object under a 12 mm. objective, *Marsipella spiralis* looks exactly like a piece of white string.

The protoplasm is dark brown in color and appears to run the entire length of the tube.

Marsipella spiralis is one of the most interesting species we have met. The use of sponge spicules, either entire or fragmentary, as building material is of frequent occurrence in the Foraminifera, but we know of no other species, except its near relative, *Marsipella cylindrica* (Brady) and *Technitella legumen* (Norman), in which sponge spicules are employed in a manner or for purposes which in any organism of higher development than the Foraminifera, would presuppose "intelligence" on the part of the builder.

The sponge spicules employed by *Marsipella spiralis* are almost without exception fragments. They are selected of practically uniform length, 0.06–0.1 mm., and arranged at angles between 30° and 45° around the tube. The spiral is always left-handed. It is obvious that the strength of the tube is greatly increased by the spiral arrangement of the spicules; indeed, *Marsipella* has made the same great discovery as the man who first observed that a twisted string was stronger than an untwisted wisp of fibers.

Marsipella spiralis is confined to a limited area, so far as our observations go. It occurs rarely in a rich foraminiferous mud dredged by the *Goldseeker* in the North Sea (Haul 145, Station IXB, depth 330 meters), and an occasional specimen is to be found at adjacent stations, especially Station IX (61° 34′ N.; 2° 4′ E., 390 meters). No specimen has yet been found showing definite initial or final portions of the tube, all being more or less fragmentary; but the fact that nearly all the fragments were living when dredged, as was proved by the presence of protoplasm in the tube, seems to show that the tube may grow indefinitely, and that injuries to the extremity of the tube do not effect the life of the animal. The tube is doubtless flexible when living, like *Bathysiphon filiformis* (Sars). The fragments vary from 1 to 4 mm. in length. The average external diameter of the tube is 0.08 mm.

MARSIPELLA ECHINATA (de Folin).

Bathysiphon echinatus DE FOLIN, Act. Soc. Linn. Bordeaux, vol. 40 (ser. 4, vol. 10), 1886, p. 278, pl. 6, fig. 3.
Marsipella echinata RHUMBLER, Arch. Prot., vol. 3, 1903, p. 266, fig. 111 (in text).

Description.—Test free, irregularly cylindrical, open at one end; wall composed largely of elongate sponge spicules on the exterior, sand grains beneath, spicules placed crosswise and outer surface rough bristly, the spicules pointing at an acute angle backward, aperture formed by the open end of the tube.

Length, 9–10 mm.; breadth, 0.5–0.6 mm.

Distribution.—Described by de Folin from the Gulf of Gascony.

This seems to be a *Marsipella* rather than *Bathysiphon* if the spicular condition of the exterior is taken into consideration. It might have been also a very spiculiferous form of *Saccorhiza*. Nothing is known of it except de Folin's description and figure.

Genus BATHYSIPHON G. O. Sars, 1871.

Bathysiphon (M. Sars in MS.) (type, *B. filiformis* G. O. Sars) G. O. SARS, Förh. Vid. Selsk. Christiania, 1871 (1872), p. 251.—NORMAN, Rep. Brit. Ass. (Swansea), 1880, pp. 389–390.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 248.—DE FOLIN, Act. Soc. Linn, Bordeaux, vol. 40, 1886, p. 273.—RHUMBLER, Arch. Prot., vol. 3, 1903, p. 269.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 30.

Description.—Test free, cylindrical, often tapering slightly, straight or more often somewhat curved, in some species externally constricted but not correspondingly constricted internally; wall composed of a base of broken sponge spicules cemented and overlaid with a fine grained apparently siliceous cement, aperture at the ends of the tube.

There are several species of this genus known from the Atlantic, mostly from the cooler waters.

BATHYSIPHON FILIFORMIS G. O. Sars.

Plate 11, figs. 4, 5.

Bathysiphon filiformis (M. Sars MS.) G. O. SARS, Förh. Vid. Selsk. Christiania, 1871 (1872), p. 251.—NORMAN, Rep. Brit. Ass. (Swansea), 1880, p. 389.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 248, pl. 26, figs. 15–20.—GOËS, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 16, pl. 3, figs. 39–41.—DE FOLIN, Act. Soc. Linn. Bordeaux, vol. 40, 1886, p. 279, pl. 6, figs. 4*a–e*.—CHAPMAN, Proc. Zool. Soc. London, 1895, p. 12.—GOËS, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 23, pl. 1, figs. 11, 12.—RHUMBLER, Arch. Prot., vol. 3, 1903, p. 270, fig. 116 (in text).—SCHUBERT, Jahrb. geol. Reichsanst, vol. 53, 1904, p. 412, pl. 19, fig. 13.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 31, figs. 17–21 (in text).—PEARCEY, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 999.

Description.—Test free, cylindrical, of nearly uniform diameter throughout, slightly curved, chamber tubular, of uniform diameter,

wall composed of felted and slightly cemented sponge spicules and fine amorphous material in varying quantitied, rather soft, almost friable, surface with a film of dull black or light brown; in worn specimens white.

Length, up to 50 mm. or more; diameter, up to 4 mm.

Distribution.—The recorded distribution of this species is practically world-wide. On the European side of the Atlantic it was described from Hardanger Fjord, Norway (M. Sars, G. O. Sars, Norman), and is recorded from the Bay of Biscay (Norman, de Folin) as well as from the Mediterranean and off the Azores. From the American side it is unrecorded. An examination of the *Albatross* material gives specimens from numerous stations especially massed between Cape Hatteras and the latitude of Cape Cod with a single station off Nova Scotia. The depths range from 82 to 1,859 fathoms, only two stations, however, being in depths greater than 1,000 fathoms, and the bottom temperatures range from 38.6° to 40.6° with one at 45° F.

From nearly all of these the material where unworn has a dark coating over the whitish interior and is without constricted or jointed areas. At one station material was found like the typical European material, white and distinctly jointed. In comparison with *B. rufus* it is a species of colder waters as far as the data from the *Albatross* material shows. *B. filiformis* does not occur in the material south of Cape Hatteras, while *B. rufus* is found in the Gulf of Mexico and Caribbean Sea.

Pearcey speaks of material obtained from the Antarctic having a considerable number of mineral particles built into the walls, due, as he thinks, to the nature of the glacial deposit with which the specimens occur.

Bathysiphon filiformis—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9607	U.S.N.M.	2	D2046....	40 02 49 N.; 68 49 00 W.	407	40	bu. m.....	Few.
9608	U.S.N.M.	2	D2048....	40 02 00 N.; 68 50 30 W.	547	39	crs. m. g....	Few.
9609	U.S.N.M.	1	D2110....	35 12 10 N.; 74 57 15 W.	516	40	bu. m.....	Rare.
9610	U.S.N.M.	2	D2111....	39 09 50 N.; 74 57 40 W.	938	.....	gn. m.....	Rare.
9611	U.S.N.M.	10	D2172....	38 01 15 N.; 73 44 00 W.	568	39	gn. m.....	Common.
9612	U.S.N.M.	1	D2187....	39 49 30 N.; 71 10 00 W.	420	39.7	gn. m. s.....	Few.
9613	U.S.N.M.	10+	D2202....	39 38 00 N.; 71 39 45 W.	515	39.1	gn. m.....	Common.
9614	U.S.N.M.	1	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Rare.
9615	U.S.N.M.	1	D2212....	39 59 30 N.; 70 30 45 W.	428	40	gn. m.....	Rare.
9616	U.S.N.M.	10+	D2213....	39 58 30 N.; 70 30 00 W.	384	39.5	gn. m.....	Few.
9264	U.S.N.M.	1	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Few.
9265	U.S.N.M.	5	D2237....	39 12 17 N.; 72 09 30 W.	520	39.5	gn. m.....	Few.
9617	U.S.N.M.	1	D2263....	37 08 00 N.; 74 33 00 W.	430	.....	gn. m.....	Rare.
9266	U.S.N.M.	10+	D2504....	44 23 00 N.; 61 22 45 W.	82	40.6	bk. m. g.....	Common.
9267	U.S.N.M.	3	D2552....	39 47 04 N.; 70 35 00 W.	721	39.6	gy. oz.....	Few.
9268	U.S.N.M.	1	D2713....	38 20 00 N.; 70 08 30 W.	1,859	.....	br. oz.....	Rare.
9269	U.S.N.M.	10+	D2729....	36 36 00 N.; 74 32 00 W.	679	.....	dk. gn. m...	Common.
9270	U.S.N.M.	10+	D2731....	36 45 00 N.; 74 28 00 W.	781	.....	gy. oz.....	Common.

BATHYSIPHON CAPBRITONENSIS de Folin.

Bathysiphon capbritonensis DE FOLIN, Act. Soc. Linn. Bordeaux, vol. 40 (ser. 4, vol. 10), 1886, p. 274, pl. 5, figs. 1*a–e*.—RHUMBLER, Arch. Prot., vol. 3, 1903, p. 269, fig. 115 (in text).

Description.—Test free, large, cylindrical, slightly tapering and slightly curved, closed at one end; composed of siliceous sand and sponge spicules with a slight amount of cement; exterior smooth except for irregular annular rings slightly raised, wall white except the exterior which is light brown; aperture formed by the open end of the tube.

Length, 43 mm.; breadth, 2 mm.

Distribution.—De Folin obtained the species from material dredged off Cape Breton, Gulf of Gascony; from off Corsica in 727 meters, and from the coast of Morocco in 370 meters.

BATHYSIPHON STRICTUS de Folin.

Bathysiphon strictus DE FOLIN, Act. Soc. Linn. Bordeaux, vol. 40 (ser. 4, vol. 10), 1886, p. 285, pl. 8, figs. 10*a–b*.—RHUMBLER, Arch. Prot., vol. 3, 1903, p. 271, fig. 119 (in text).

Description.—Test free, elongate cylindrical, not tapering, slightly curved, wall composed in large part of long acerose spicules with more or less white amorphous material, surface slightly roughened, the spicules placed longitudinally or slightly oblique; when wet, the test is translucent and flexible, white; aperture at the end of the tube.

Length, 10–15 mm.; breadth, 0.2–0.4 mm.

Distribution.—Type-specimens were described by de Folin from the Gulf of Gascony, depth not given.

BATHYSIPHON RUFUS de Folin.

Bathysiphon rufum DE FOLIN, Act. Soc. Linn. Bordeaux, vol. 40, (ser. 4, vol. 10), 1886, p. 283, pl. 6, figs. 8*a–e*.—GOËS, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 23, pl. 1, fig. 10.—FLINT, Rep. U. S. Nat. Mus., 1897 (1899), p. 267, pl. 7.—RHUMBLER, Arch. Prot., vol. 3, 1903, p. 270, fig. 118 (in text).—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 32, fig. 22 (in text).

Description.—Test free, elongate, tapering, slightly curved, exteriorly somewhat irregularly constricted, smooth and polished, wall comparatively thick, composed of sponge spicules, usually fragmentary, with a very hard siliceous cement in great preponderance; color reddish or yellowish brown; aperture circular at the end of the test.

Length, up to 12 mm.; diameter of larger end, about 0.5 mm.

Distribution.—De Folin described this species from the Gulf of Gascony, and that seems to be the only record for that side of the Atlantic. On the western side it has been recorded by Goës from the Caribbean Sea, 1,345 fathoms, and by Flint from the Gulf of Mexico, 730 fathoms, and from off Bahia, Brazil, 1,019 fathoms. In the, *Albatross* dredgings it has occurred at numerous stations, all, however,

south of the latitude of Cape Cod. It occurs at scattered stations from latitude 40° N. southward off our coast at several stations in the Gulf of Mexico and Caribbean Sea, and I have had material from D2761 off Bahia, Brazil. The stations range in depth from 93 to 2,069 fathoms and bottom temperatures from 37.7° to 42.3° F.

Although these bottom temperatures are not high, the distribution of this species is much more tropical in its records than that of *B. filiformis*, which apparently does not get into the Gulf of Mexico or the Caribbean Sea.

Bathysiphon rufus—*material examined.*

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9618	U.S.N.M.	2	D2018....	37 12 22 N.; 74 20 04 W.	788	39	bu. m.....	Rare.
9619	U.S.N.M.	1	D2035....	39 26 16 N.; 70 02 37 W.	1,362	.....	glob. oz.....	Rare.
9620	U.S.N.M.	1	D2043....	39 49 00 N.; 68 28 30 W.	1,467	38.5	glob. oz.....	Few.
9621	U.S.N.M.	1	D2105....	37 50 00 N.; 73 03 50 W.	1,395	41	glob. oz.....	Few.
9622	U.S.N.M.	1	D2110....	35 12 10 N.; 74 57 15 W.	516	40	bu. m.....	Rare.
9623	U.S.N.M.	2	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s.....	Rare.
9624	U.S.N.M.	2	D2140....	17 36 10 N.; 76 46 05 W.	966	39.7	s.....	Rare.
9625	U.S.N.M.	1	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Rare.
9271	U.S.N.M.	1	D2229....	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Rare.
9626	U.S.N.M.	1	D2392....	28 47 30 N.; 87 27 00 W.	724	40.7	br. gy. m....	Rare.
9272	U.S.N.M.	2	D2505....	44 23 30 N., 61 44 15 W.	93	42.3	dk. br. m....	Rare.
9273	U.S.N.M.	2	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Few.
9274	U.S.N.M.	2	D2562....	39 15 30 N.; 71 25 00 W.	1,434	37.3	gy. oz.....	Rare.
9627	U.S.N.M.	8	D2678....	32 40 00 N.; 76 40 30 W.	731	38.7	lt. gy. oz.....	Few.
9628	U.S.N.M.	4	D2679....	32 40 00 N.; 76 40 30 W.	782	38.6	lt. gy. oz.....	Few.
9629	U.S.N.M.	1	D2761....	15 39 00 N.; 38 32 54 W.	818	39	pter. oz.....	Rare.
9275	U.S.N.M.	2	H67.....	16 13 45 N.; 64 22 30 W.	2,069	.....	co. s. for. sh..	Rare.
9276	U.S.N.M.	1	H88.....	12 29 00 N.; 62 38 30 W.	1,630	.....	m. bk. sp. for.	Rare.

BATHYSIPHON MINUTA Pearcey.

Bathysiphon minuta Pearcey, Millport Marine Biol. Stat. Comm., vol. 1, 1900, p. 39, pl. 2, figs. 1–5.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 38.

The original description was as follows:

Test a long, thin, very narrow, gradually tapering tube, with finely arenaceous walls consisting of fine mineral particles loosely cemented to a chitinous lining, when dried or mounted in balsam, the walls of the tube collapse at intervals. Color light gray to white.

Distribution.—The author of this species described it from the English coast and it has not been recorded elsewhere.

BATHYSIPHON ARGENTEUS Heron-Allen and Earland.

Plate 12, figs. 1–3.

Bathysiphon argenteus Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 38, pl. 3, figs. 1–3; Trans. Linn. Soc. London, vol. 11, pt. 13, Mar. 1916, p. 218.

The original description is as follows:

Test free, minute, tubular, of a silvery lustre when viewed as an opaque object, flexible when living, rather brittle in the dry condition. Consisting of very thin chitinous tube of nearly even diameter throughout, but sometimes exhibiting a slight increase in diameter with growth. The tube is open at bottom extremities

which are somewhat constricted and rounded. Viewed as a transparent object (in balsam) under a high magnification, the wall of the tube is seen to contain large numbers of extremely minute rod-shaped bodies, which are, as a rule, laid more or less at right angles to the long axis of the tube, the characteristic metallic luster of the tube when viewed as an opaque object is apparently due to the diffraction of the rays of light falling on these parallel layers of spicules. The tube is not affected by boiling in nitric acid for a few seconds, so the spicules can not be calcareous.

Length of tube, up to 2mm.; external diameter, 0.03 to 0.05 mm.; thickness of tube wall, 0.002 to 0.004 mm.; spicules vary from 0.001 to 0.006 mm. in length.

The authors described this species from Killary Bay, on the west coast of Ireland. They record it also from 10 to 200 fathoms around the coast of Scotland and in the North Sea across to the coast of Norway.

Although searched for, I have been unable to find this species in material from this side of the Atlantic.

Genus RHIZAMMINA H. B. Brady, 1879.

Rhizammina H. B. Brady (type, *R. algæformis* H. B. Brady), Quart. Journ. Micr. Sci., vol. 19, 1879, p. 39.—Bütschli in Bronn, Klassen und Ordnungen des Thierreichs, vol. 1, 1880, p. 195.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 274.—Rhumbler, Arch. Prot., vol 3, 1903, p. 252.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 33.

Marsipella (part) Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 668.

Description.—Test free, consisting of a simple or dichotomously branching, flexible tube, wall largely chitinous, bearing various foreign bodies attached to the exterior.

Two species only are known and both occur in small numbers as far as the *Albatross* material has shown in the Atlantic, but they are widely distributed.

RHIZAMMINA ALGAEFORMIS H. B. Brady.

Plate 11, figs. 2, 3.

Rhizammina algæformis H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 39, pl. 4, figs. 16, 17; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 274, pl. 28, figs. 1–11.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 20.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 272, pl. 15, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 252, fig. 92 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 33, fig. 23 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 999.—Heron-Allen and Earland, Trans. Zool. Soc., London, vol. 20, 1915, p. 611; Trans. Linn. Soc., London, vol. 11, pt. 13, 1916, p. 221.

Description.—Test free, consisting of a dichotomously branching flexible tube, forming irregular masses of indefinite size; wall thin, largely chitinous but with various sorts of foreign matter attached to the exterior, either sand or other foraminiferal tests according to the character of the bottom outer surface when free from foreign material somewhat roughened, color of the chitinous tubes brown or gray.

Diameter of tube, 0.126–0.315 mm.

Distribution.—Brady gives three Atlantic stations for this delicate species, *Porcupine* station 37, 2,435 fathoms, and "two other localities in the North Atlantic, at depths of 630 and 1,125 fathoms, respectively." Heron-Allen and Earland record it from two stations off the west of Scotland, making the first record from British waters and mention the fact that it is "common in deep water off the Irish and west Scottish coasts." Pearcey records it from diatom ooze in the Antarctic 2,103 and 2,180 fathoms. Heron-Allen and Earland record it from the Kerimba Archipelago off the southeastern coast of Africa "attached to an oyster shell in shallow water." The majority of them were simple tubes, the remainder furcating irregularly. As the original description says "free" and as it is a dichotomously branching form from cold waters it is suggested that the Kerimba attached material from shallow, warm tropical waters may be another thing.

Brady's material showed a very large per cent of silica making up the test in alcoholic or dried material. The amount of chitinous material is sufficient, however, to make the test very flexible. On drying specimens are very easily broken and in dried dredged material only small fragments are usually present. Such fragmentary specimens have occurred at a few *Albatross* stations in the western Atlantic, four southward of Georges Bank and one off the Central American coast in the Caribbean Sea. One station is in 382 fathoms, the others from 1,582 to 1,917 fathoms.

Rhizammina algaeformis—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9836	U.S.N.M.	2	D2097....	37 56 20 N.; 70 51 30 W.	1,917	.....	glob. oz.....	Rare.
9837	U.S.N.M.	1	D2150....	13 34 45 N.; 81 21 10 W.	382	45.75	wh. crs. s...	Rare.
9420	U.S.N.M.	1	D2228....	37 25 00 N.; 73 06 00 W.	1,582	36.8	br. m.....	Rare.
9421	U.S.N.M.	1	D2713....	38 20 00 N.; 70 08 30 W.	1,859	.....	br. oz.....	Rare.
9422	U.S.N.M.	1	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Rare.

RHIZAMMINA INDIVISA H. B. Brady.

Plate 12, figs. 7–10.

Rhizammina indivisa H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 277, pl. 29, figs. 5–7.—Egger, Abh. Bay. Akad. Wiss. München, vol. 18, 1893, p. 256, pl. 4, fig. 17.—Chapman, Proc. Zool. Soc. London, 1895, p. 14.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 20.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 272, pl. 15, fig. 2.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 252, fig. 91 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 34, fig. 24 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 999.

Marsipella indivisa Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 668.

Description.—Test free, cylindrical, somewhat flexible, often tapering near the ends; wall composed of chitinous material, thin, with a variable amount of sand grains or more often other foraminiferal tests attached to the exterior; open ends of the tube serving as the apertures.

Length, up to 10 mm.; diameter, 0.25–0.40 mm.

Distribution.—Brady recorded the species from the Faroe Channel in 540 fathoms; it also occurs off the Cape Verde Islands (Egger); Gulf of Mexico, 211 to 1,345 fathoms (Goës); from four *Albatross* stations D2234, southward of Long Island; D2355, Strait of Yucatan; D2380, Gulf of Mexico; and D2760, coast of Brazil ranging from 400 to 1,400 fathoms (Flint).

In the *Albatross* material that I have examined it has occurred at numerous stations from off Nova Scotia to the Gulf of Mexico and the Caribbean Sea, depths ranging from 788 to 2,045 fathoms with two shallower stations at 382 and 82 fathoms. Bottom temperatures for the most part range from 36.8° to 40.6° F.

When the outer attached foraminiferal tests are rubbed away in dry material a chitinous test is left with a certain amount of fine grayish material covering the surface except where the larger particles such as other foraminiferal tests were attached. At these places there are apparently at first glance round openings, but close observation will show that there is here a very thin light-brown chitinous layer nearly transparent. The finer material was filled in after the larger particles for there is no coating below them. One of Brady's figured specimens, *Challenger* Report (pl. 29, fig. 6), shows this apparently perforated condition of the test. When all the larger particles are rubbed away a peculiar looking test is the result.

Rhizammina indivisa—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9838	U.S.N.M.	1	D2035....	39 26 16 N.; 70 02 37 W.	1,362	.....	glob. oz.....	Rare.
9839	U.S.N.M.	1	D2097....	37 56 20 N.; 70 57 30 W.	1,917	.....	glob. oz.....	Rare.
9840	U.S.N.M.	4	D2150....	13 34 45 N.; 81 21 10 W.	382	45.75	wh. crs. s....	Common.
9841	U.S.N.M.	10+	D2218....	37 12 22 N.; 74 20 04 W.	788	39	gy. m.....	Common.
9423	U.S.N.M.	4	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Few.
9842	U.S.N.M.	1	D2383....	28 32 00 N.; 88 06 00 W.	1,181	39.8	br. gn. m....	Few.
9424	U.S.N.M.	1	D2504....	44 23 00 N.; 61 22 45 W.	82	40.6	ok. m. g.....	Few.
9425	U.S.N.M.	1	D2564....	39 22 00 N.; 71 23 30 W.	1,390	37.3	gy. oz.....	Few.
9426	U.S.N.M.	2	D2713....	38 20 00 N.; 70 08 30 W.	1,859	.....	br. oz.....	Few.
9427	U.S.N.M.	1	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Few.

Subfamily 2. SACCAMMININAE.

Genus PSAMMOSPHAERA F. E. Schulze, 1875.

Psammosphaera F. E. SCHULZE (type, *P. fusca* F. E. Schulze), II Jahr. Comm. Wiss. Unt. deutsch. Meer in Kiel, 1875, p. 113.—BÜTSCHLI, in Bronn, Klassen und Ordnungen Thierreichs, vol. 1, 1880, p. 202.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 249.—FLINT, Rep. U. S. Nat. Mus., 1897 (1899), p. 267.—EIMER and FICKERT, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 598.—RHUMBLER, Arch. Prot., vol. 3, 1903, p. 241.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 35.

Saccammina (part) RHUMBLER, Zeitschr. Wiss. Zool., vol. 57, 1894, p. 462; Nachr. Ges. Wiss. Göttingen, 1895, pp. 81, 82.

Description.—Test free or attached, single chambered, usually spherical, no definite aperture, the pseudopodia making their way out through the interstitial openings between the elements of the test; wall of sand grains, mica flakes, sponge spicules, or other foraminiferal tests firmly cemented.

The selective power shown by the various species of this genus are of great interest. *P. fusca* using sand grains, *P. bowmanni* making its test of mica flakes, *P. rustica* of sponge spicules, and *P. testacea* using other foraminiferal tests to construct its own. The selecting by a single-celled organism is all the more remarkable.

PSAMMOSPHAERA FUSCA F. E. Schulze.

Plate 13, figs. 1–6; plate 14, figs. 1–3.

Psammosphaera fusca F. E. Schulze, II Jahr. Comm. Wiss. Unt. deutsch. Meer in Kiel, 1875, p. 113, pl. 2, figs. 8*a–f*.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 249, pl. 18, figs. 1, 5–8 (not 2–4).—H. B. Brady, Parker, and Jones, Trans. Zool. Soc., vol. 12, 1888, p. 217.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 14, pl. 3, fig. 19.—Chapman, Proc. Zool. Soc. London, 1895, p. 13.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 268, pl. 8, fig. 1.—Millett, Journ. Roy. Micr. Soc., 1899, p. 251.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 242, fig. 75 (in text).—Sidebottom, Mem. and Proc. Manchester Lit. and Philos. Soc., vol. 49, No. 5, 1905, p. 1, pl. 1, fig. 1.—Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, pl. 33, fig. 3.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 36, figs. 25–28 (in text).—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, No. 3, 1911, p. 7.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 40; Journ. Roy. Micr. Soc., 1913, p. 16, pl. 2, figs. 3–6, 10–16.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1000.—Heron-Allen and Earland, Trans. Zool. Soc., vol. 20, 1915, p. 609; Trans. Linn. Soc. London, vol. 11, 1916, p. 219.

Description.—Test free in larger specimens or attached to pebbles or other larger material, generally subspherical, wall single chambered, of a single layer of rather coarse sand grains, exterior rough, interior more smoothly finished, cement gray or yellowish brown; no definite apertures.

Diameter, up to 4 mm.

Distribution.—From the records this species is very widely distributed; usually, it seems, in cooler waters, although Heron-Allen and Earland record it from the Kerimba Archipelago in shallow warm waters. The type station is Hougesund, Norway, 120 fathoms, and it is known from various stations about the British Isles and North Sea. On the western side it is recorded off Havana, Cuba, by Flint, and off the Carolina coast. In the *Albatross* and other material it has occurred at numerous stations from Nova Scotia to Cape Hatteras with peculiar black, free specimens off the Carolina coast as noted by Flint from the same material.

In shallow water both on our coasts and the European side it tends to an attached form, while in deeper water it is more often

free, Heron-Allen and Earland[1] say that the "protoplasm extrudes through the fine pores of the cement and functions of digestion are carried on outside of the test." If this is true, what happens in such forms as this and *Crithionina*, where there is no large aperture when the nuclear divisions occur and the macrospheric young or zoospores of the microspheric form are produced? Are these produced outside the test or does the test resorb a portion of its cemented wall and break down? Some such occurrence must take place at this time.

Psammosphaera fusca—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		° F.		
9769	U.S.N.M.	1	D2046....	40 02 49 N.; 68 49 00 W.	407	40	bu. m.....	Rare.
9914	U.S.N.M.	.....	D2074....	41 43 00 N.; 65 21 50 W.	1,309	40	m. & st.....	Rare.
9770	U.S.N.M.	1	D2093....	39 42 50 N.; 71 01 20 W.	1,000	39	s. m.....	Rare.
9771	U.S.N.M.	1	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s.....	Rare.
9772	U.S.N.M.	1	D2171....	37 59 30 N.; 73 48 40 W.	444	39.5	gn. m.....	Rare.
9773	U.S.N.M.	3	D2174....	38 15 00 N.; 72 03 00 W.	1,594	.....	gy. m.....	Few.
9774	U.S.N.M.	3	D2189....	39 49 30 N.; 70 26 00 W.	600	39.7	gn. m. s.....	Few.
9775	U.S.N.M.	2	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Few.
9776	U.S.N.M.	1	D2217....	39 47 20 N.; 69 34 15 W.	924	38.1	gy. m.....	Rare.
9403	U.S.N.M.	1	D2231....	38 29 00 N.; 73 09 00 W.	965	36.8	gy. oz.....	Rare.
9780	U.S.N.M.	10+	D2243....	40 10 15 N.; 70 26 00 W.	63	52.4	gn. m.....	Common.
9404	U.S.N.M.	1	D2247....	40 03 00 N.; 69 57 00 W.	78	51.9	gy. m. s.....	Rare.
9405	U.S.N.M.	10+	D2264....	37 07 50 N.; 74 34 20 W.	167	46.8	gy. s.....	Common.
9406	U.S.N.M.	10+	D2314....	32 43 00 N.; 77 51 00 W.	159	47.4	crs. s. bk. sp. brk. sh.	Common.
9407	U.S.N.M.	1	D2531....	40 42 00 N.; 60 33 00 W.	853	34.4	gy. m.....	Rare.
9408	U.S.N.M.	1	D2547....	39 54 30 N.; 70 20 00 W.	390	39.6	gn. m.....	Rare.
9409	U.S.N.M.	2	D2552....	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.....	Rare.
9410	U.S.N.M.	10	D2572....	40 29 00 N.; 66 04 00 W.	1,769	37.8	gy. oz.....	Few.
9411	U.S.N.M.	1	D2581....	39 43 00 N.; 71 34 00 W.	394	.....	gn. m.....	Rare.
9412	U.S.N.M.	3	D2582....	39 38 00 N.; 70 22 00 W.	1,004	.....	gn. m. s.....	Few.
9413	U.S.N.M.	2	D2697....	32 40 00 N.; 76 40 30 W.	782	38.6	lt. gy. oz.....	Few.
9414	U.S.N.M.	1	D2706....	41 28 30 N.; 65 35 30 W.	1,188	.....	gy. oz. for...	Rare.
9915	U.S.N.M.	.....	Speedwell 75	Sandwich Point off Halifax Harbor.	.....	.....	.....	Rare.
9922	U.S.N.M.	.....	219	42 30 00 N.; 70 33 00 W.	32	55.5	.....	Rare.
9415	U.S.N.M.	2	Goldseeker	61 03 00 N.; 2 20 00 W.	1,418m	.....	.....	Rare.

PSAMMOSPHAERA PARVA Flint.

Plate 12, figs. 4–6.

Psammosphaera parva Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 268, pl. 9, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 242, fig. 77 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 36, figs. 29, 30 (in text).

Psammosphaera fusca (part) H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 250, pl. 18, figs. 2–4 (not 1, 5–8).—Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, pl. 35, fig. 13.

Psammosphaera fusca Schulze, var. *parva* Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1913, p. 17, pl. 2, figs. 7, 8.

Description.—Test free, usually with a single long acerose sponge spicule incorporated in the test, which is small, rounded, single chambered; wall of sand grains firmly cemented by a reddish-brown cement; aperture indefinite, probably provided for by fine interstitial openings between the sand grains.

Diameter, usually between 0.30 and 0.75 mm.

[1] Journ. Roy. Micr. Soc., 1913, p. 16, etc.

Distribution.—This species has not been distinguished often from the related species *P. fusca*. Flint described it from the coast of Brazil, *Albatross* D2760 in 1,019 fathoms. Heron-Allen and Earland record it off the Hebrides.

It is evidently a distinct species from *P. fusca* and the habit of building a large sponge spicule into the test appears distinctive. The following notes from Heron-Allen and Earland [1] are of interest in this connection:

In * * * *parva*, the test, which is always of comparatively small dimensions, is nearly symmetrical and spherical, composed of small sand grains rigidly cemented together, without definite aperture of any kind and very often around a sponge spicule which projects on opposite sides of the sphere, sometimes to a length many times exceeding the total diameter of the test. * * * This spicular form is of very infrequent occurrence, and is in our experience extremely local. [In their paper, they have *P. fusca* from 85 out of 145 stations examined and spiculiferous var. *parva* occurs at but two stations, and at only one of these was more than an occasional specimen found.] The one exception is haul 228, taken off St. Kilda west of the Hebrides in 1,600 meters, the sea bottom being *Globigerina* ooze. Here the spiculiferous variety *parva* is of quite frequent occurrence. In view of such facts, and of the added fact that two species of *Psammosphaera*, which we have described from *Goldseeker's* dredgings [*P. bowmanni*, mica plates, and *P. rustica*, sponge spicules] display marked selective powers, we can not but arrive at the conclusions that the presence of this central spicule in var. *parva* is not fortuitous, but that the animal deliberately chooses the spicule as a main constituent of its "house," and constructs its abode round the spicule in order to obtain the increased support afforded by its projections in supporting itself upon the surface layers of the bottom ooze.

I have had specimens from the following list of stations:

Psammosphaera parva—material examined.

Cat. No.	Coll. of—	No. of speci-mens.	Station.	Locality.	Depth in fath-oms.	Bot-tom tem-pera-ture.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F		
9778	U.S.N.M.	1	D2381	28 05 00 N.; 87 56 15 W	1,330	.....	lt. br. m.....	Rare.
9416	U.S.N.M.	2	D2393	28 43 00 N.; 87 14 30 W.	525	41.1	lt. gy. m.....	Rare.
9777	U.S.N.M.	6	D2679	32 40 00 N.; 76 40 30 W.	782	38.6	lt. gy. oz.....	Few.
			D2760	12 07 00 S.; 37 17 00 W.	1,019	39.5	br. co.....	Few.
9779	U.S.N.M.	1	D2761	15 39 00 S.; 38 32 54 W.	818	39	pter. oz.....	Rare.
9417	U.S.N.M.	1	H48	17 42 00 N.; 65 12 40 W.	978	.....	co. oz. for...	Rare.

PSAMMOSPHAERA BOWMANNI Heron-Allen and Earland.

Plate 9, figs. 5, 6; plate 10, fig. 5.

Psammosphaera bowmanni Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1912, p. 385, pl. 5, figs. 5, 6; pl. 6, fig. 5; Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 39; Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 219.

The following is from the original description:

Test free, monothalamous, consisting of a more or less irregularly polyhedral chamber, constructed of small flakes of mica cemented together at the edges by a light-gray mudlike cement. No definite oval aperture. There is often a small opening where two or three of the mica flakes meet at an acute angle, due to

[1] Journ. Roy. Micr. Soc., 1913, p. 17.

absence of cement at the point of juncture. This opening, however, appears to be merely accidental and is not present in the majority of specimens. The cement used is not ferruginous, but appears to consist of very fine homogeneous mud. It is absorbent and very easily broken up, and is no doubt very porous, thus serving for the passage of the protoplasmic extensions.

The specimens vary considerably in size and shape, but the most usual form has a length about twice its breadth.

Average length, 0.4–0.6 mm.; breadth, 0.25–0.35 mm.

Distribution.—This species was originally described from the deep water in the gully off Burghead, in the Moray Firth, *Goldseeker*, haul 73, 35 fathoms, and haul 7791, in 55 meters. From the Clare Island Survey the authors record single specimens from four stations and two from a fifth, depths varying from 3 to 15 fathoms. The further record is from two stations off the west of Scotland, each in 30 fathoms, and a single specimen at each station.

PSAMMOSPHAERA RUSTICA Heron-Allen and Earland.

Plate 9, figs. 3, 4; plate 10, figs. 2–4.

Psammosphaera rustica Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1912, p. 383, pl. 5, figs. 3, 4; pl. 6, figs. 2–4.

The original description is as follows:

Test free, monothalamous, consisting of a polyhedral chamber constructed almost entirely of sponge spicules, whole or fragmentary, neatly cemented together in a single layer, and with a minimum quantity of ferruginous cement. The cement is confined to the actual line of attachment between the edges of the spicules, and does not extend over the outer or inner wall of the test. There is no definite oral aperture. Average size, 0.3–0.5 mm. (chambers only).

Hardly any two specimens exhibit an identical shape or external appearance. This diversity is due to the methods of construction and material employed. Apparent method of construction is to select a number of long slender spicules often 2 or 3 mm. or more in length. These are placed like tent poles at various angles about 0.5 mm. apart, forming a rough open-work figure inclosing a central space between the points of intersection of the poles. The open spaces in the wall are then filled in with shorter fragments of spicules carefully selected for length, so as just to fill the required space. The animal thus secures the nearest possible approach to a spherical chamber obtainable with the material employed, the salient angles being the points where two or more of the "tent poles" join. The long spicules employed as "tent-poles" project irregularly all over the surface of the test in perfect specimens, and probably serve a secondary purpose as catamaran spars in supporting the animal in the surface layer of ooze. They are, however, very fragile, and are frequently more or less damaged, if not destroyed, in the process of cleaning the dredged material.

The internal cavity of the test is quite devoid of projecting spicules and is not coated with cement.

As a rule, spicules only are employed in the construction of the test, but occasionally a minute grain of sand or flake of mica is used to close the little corner space where two or more "tent-pole" spicules meet at an acute angle. Still more rarely this angular space is left unclosed, thus constituting an aperture to the test. The presence of such apertures must, however, be regarded as abnormal.

Composite specimens were found with two to five individuals in an irregular mass. The only union between such specimens is that they have used in common one or more of the same long spicules. Usually the groups are irregular, but in one of the

figured groups it is a linear series of three distinct chambers unconnected except by the elongate "tent-pole" spicules.

We have experienced some hesitation in allotting this interesting species to its genus. In spite of the selective power displayed, the test is evidently of the simplest type of Rhizopod structure, and the absence of a definite oral aperture combined with the evidence which we have discovered of selective power in another unquestionable species of *Psammosphaera* (*P. bowmanii*, sp. n.), has guided us in our decision to refer the specimen to the genus *Psammosphaera*.

P. rustica, though never of very frequent occurrence, is met with at several of the *Goldseeker* stations round the coast of Scotland. It occurs most frequently at Stations IX and IX*B* in the North Sea (61° 34′ N.; 2° 4′ E., 390 meters), and stations 53 (59° 36′ N.; 70° W., 1,000 meters) and haul 228 (57° 59′ N.; 10° 34′ W., 1,600 meters), on the west coast of Scotland, but occasional specimens are to be met with at intermediate localities and depths.

PSAMMOSPHAERA TESTACEA (Flint).

Plate 15, figs. 1–3.

Psammosphaera fusca, var. *testacea* Flint, Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 268, pl. 8, fig. 2.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1913, p. 18, pl. 2, fig. 9.

Psammosphaera fusca Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10. 1909, pl. 33, fig. 4.

Description.—Test free, subspherical, wall composed of the empty tests of other foraminifera, cemented firmly, the interior of the single chamber smooth, exterior very rough; no definite aperture, the fine interstitial openings apparently serving for apertures.

Diameter, up to 3 mm.

Distribution.—Flint described this form from the Gulf of Mexico, *Albatross* stations D2358, 2383, and 2399, in 196 to 1,181 fathoms. Heron-Allen and Earland record it from about Great Britain. It has occurred frequently in Globigerina ooze. In their paper Heron-Allen and Earland record the species at but 7 out of 145 stations from which material was examined, and at only 2 of these was it recorded as common. These were in 362 and 1,600 meters, the latter off St. Kilda, west of the Hebrides, in *Globigerina-ooze*. They give the following note. In comparing this with *P. parva*, "*P. fusca*, var. *testacea* is of an entirely different habit. It can not in any way be regarded as a selective organism, but rather as a *Psammosphaera* which utilizes the tests of other Foraminifera in the construction of its 'house' merely because they chance to be the material most ready to hand."

Psammosphaera testacea—*material examined.*

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
.....	U.S.N.M.	.....	D 2043...	39 49 00 N.; 68 28 30 W.	1,467	38.5	glob. oz.....	Few.
9781	U.S.N.M.	1	D 2052...	39 40 05 N.; 69 21 25 W.	1,098	45	glob. oz.....	Rare.
9782	U.S.N.M.	4	D 2097...	37 56 20 N.; 70 57 30 W.	1,917	.....	glob. oz.....	Few.
9418	U.S.N.M.	5	D 2550...	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Few.
9419	U.S.N.M.	2	H 67.....	16 13 45 N.; 64 22 30 W.	2,069	.....	co. s. for. sh.	Few.

Genus SOROSPHAERA H. B. Brady, 1879.

Sorosphaera H. B. Brady (type, *S. confusa* H. B. Brady), Quart. Journ. Micr. Sci., vol. 19, 1879, p. 28; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 251.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 235.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 37.

Description.—Test consisting of a colony of more or less inflated chambers, without definite apertures, the walls joined to one another, composed of sand grains with interstitial openings.

A single species *S. confusa* H. B. Brady is known.

SOROSPHAERA CONFUSA H. B. Brady.

Plate 15, figs. 4, 5.

Sorosphaera confusa H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 28, pl. 4, figs. 18, 19; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 251, pl. 18, figs. 9, 10.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 235, fig. 63 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 37, figs. 31, 32 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1000.

The original description was as follows:

Test free, consisting of a number of inflated or spherical chambers of nearly uniform size, irregularly crowded together and adhering to each other by their outer surfaces. Walls thin, finely arenaceous in texture, with minute interstitial orifices. General aperture wanting. Diameter of individual chambers about one twenty-fifth of an inch (1 mm.) of the entire colony, variable, sometimes one-sixth of an inch (4.5 mm.).

Distribution.—The following stations are given in the *Challenger* report for this species: South of the Rockall Bank, 630 fathoms; Faroe Channel, 542 fathoms; off Drobak, Norway; off the Azores, 900 fathoms; North Pacific, 2,900 fathoms. Pearcey records several specimens from the Weddell Sea in the Antarctic.

In the *Albatross* material that I have examined the species has occurred but once, then as a single but very typical specimen from D2043 in 1,467 fathoms, bottom temperature 38.5° F. (39° 49′ N.; 68° 28′ 30″ W.). This specimen (U.S.N.M., No. 9887) was composed of six portions, all attached with a common center as the basis but in an irregular manner. It was a reddish brown in color, made of fine sand grains, with apparently a ferruginous cement, the material near the center of the mass of a lighter color. The figure and description are from Brady.

Genus STORTHOSPHAERA F. E. Schulze, 1875.

Storthosphaera F. E. Schulze (type, *S. albida* F. E. Schulze), 11 Jahresb. Comm. wiss. Untersuch. deutsch. Meer in Kiel, 1875, p. 113.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 240.—Schaudinn, Verh. Deutsch. Zool. Ges., 1899, p. 238.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 235.

Description.—Test free, irregularly rounded, single chambered; wall thick, composed of fine whitish sand very loosely cemented, no visible aperture.

The genus is represented by the following species:

STORTHOSPHAERA ALBIDA F. E. Schulze.

Plate 15, figs. 6–8; plate 16, figs. 1–3.

Storthosphaera albida F. E. Schulze, II Jahresb. Comm. wiss. Untersuch. deutsch. Meer in Kiel, 1875, p. 113, pl. 2, figs. 9*a–d*.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 241, pl. 25, figs. 15–17.—Egger, Abh. kon. bay. Akad. Wiss. München, vol. 18, 1893, p. 254, pl. 5, figs. 60, 61.—Goës, Köngl. Svensk. Vet. Akad. Handlingar, vol. 25, No. 9, 1894, p. 13.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 255, pl. 4, fig. 2.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 235, fig. 64 (in text).—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1915, p. 218.

Description.—Test free, rounded, ovoid or irregular in shape, consisting of a single chamber without divisions of any kind; wall of variable thickness, loosely cemented, consisting of fine white sand or amorphous material, interior smooth, rounded; exterior roughened by numerous protuberant points and ridges; no visible aperture; color whitish or grayish brown.

Diameter, up to 3 mm., usually less.

Distribution.—No well characterized material of this species was dredged by the *Challenger*, according to Brady, who records the following stations: Coast of Norway, Bukkenfiord, 365 fathoms (Schulze); Kors Fiord, 180 fathoms (Norman); Faroe Channel, 530 fathoms (Murray); and Bay of Biscay (Norman). A poor specimen possibly referable to this species was obtained by the *Challenger* from station 323, in 1,900 fathoms, in the South Atlantic.

Flint records the species from *Albatross* D2385, in 730 fathoms, in the Gulf of Mexico.

In the material I have had it has been very scarce, the following stations only having given it: D2174 in 1,594 fathoms, D2208 in 1,178 fathoms, and D2716 in 1,631 fathoms, all southwestward of Georges Banks, and D2399 in 196 fathoms and D2385 in 730 fathoms, both in the Gulf of Mexico.

Storthosphaera albida—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9889	U.S.N.M.	1	D2174....	38 15 00 N.; 72 03 00 W.	1,594	.....	gy. m.....	Few.
9890	U.S.N.M.	1	D2208....	39 33 00 N.; 71 16 15 W.	1,178	38.4	gn. m.....	Rare.
9891	U.S.N.M.	1	D2385....	28 51 00 N.; 88 18 00 W.	730	40.	gy. m.....	Few.
9513	U.S.N.M.	3	D2399....	28 40 00 N.; 86 18 00 W.	196	51.6	gy. m.....	Few.
9514	U.S.N.M.	1	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Rare.

STORTHOSPHAERA ELONGATA, new species.

Plate 18, figs. 1, 2; plate 19, fig. 1.

Description.—Test free, elongate, in the longest specimens more than twice as long as wide, consisting of a single undivided cavity,

wall comparatively thin, composed of a felted mass of fine amorphous material and a large percentage of acerose sponge spicules with little or no cement; aperture not developed, surface smooth, color grayish white.

Length, up to 8 mm.

Distribution.—The type-specimen (No. 10002, U.S.N.M.) is from *Albatross* station D2084, south of Georges Bank, in 1,290 fathoms (40° 16′ 50″ N.; 67° 05′ 15″ W.), bottom temperature 40° F. Other specimens were obtained at this station (No. 9892, U.S.N.M.) and at D2571 in 1,356 fathoms in the same general region.

This species in some ways resembles *Crithionina pisum* but is elongate, compressed, and has a thinner test.

Genus IRIDIA Heron-Allen and Earland, 1914.

Iridia Heron-Allen and Earland (type, *Iridia diaphana* Heron-Allen and Earland), Trans. Zool. Soc. London, vol. 20, pt. 12, 1914, p. 371.

Description.—Test usually attached, consisting of a single chamber lined with a chitinous, transparent membrane, the outer surface consisting of sand grains or other foreign material built up in a dome-shaped test, more or less hemispherical, aperture usually wanting.

The following species is described by the authors:

IRIDIA DIAPHANA Heron-Allen and Earland.

Thurammina papillata (?) Earland, Journ. Quekett Micr. Club, ser. 2, vol. 9, 1905, p. 201, pl. 11, figs. 6, 7; pl. 14, figs. 1–3. Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1909, p. 323.

Webbina hemisphaerica (?) Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1909, p. 325, pl. 15, fig. 14.

Iridia diaphana Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1914, p. 371, pl. 36, p. 607; Trans. Linn. Soc. London, vol. 11, 1916, p. 218; Journ. Roy. Micr. Soc., 1916, p. 37.

The original description of this species is as follows:

Test adventitious, usually attached, but occasionally more or less free, consisting of a single cavity lined with a chitinous and diaphanous membrane or pellicle. The animal commences its existence as a small hemispherical dome-shaped chamber, white or light gray in color, attached to sand grains or shell fragments, and constructed of very fine particles of mud and sand cemented together in a rather friable test with a chitinous lining. This chitinous lining is usually continued as a "floor" to the dome-shaped chamber, but in the youngest stage the chitinous "floor" is perhaps not always present. This early dome stage is sometimes furnished with an aperture at the side or top of the dome, but quite as often no special aperture is visible. The test increases in size by the protrusion of the protoplasm in irregular masses, which proceed to secrete a covering investment of sand grains of varying sizes, attached to the chitinous lining. The construction of the test becomes coarser with the growth of the organism, and the color becomes darker. With each increase in the size of the test, the inclosing wall of the preceding stage is absorbed so as to leave an undivided cavity, the shape of which varies according to the direction and manner in which additions to the original chamber have been made. In rare instances

the test spreads as a furcating tube attached to the host. The external surface of the organism is very irregular in outline, owing to the haphazard mode of growth, and the internal cavity may for the same reason become quite irregular and contorted.

Diameter in the largest specimens, 8 mm.

Distribution.—Originally described by the authors from the Kerimba Archipelago off the southeastern coast of Africa, in comparatively shallow water, it has also been recorded by them from South Cornwall, England, and off the west of Scotland. These latter specimens from the Atlantic, however, were of much smaller size than the tropical ones. In the *Albatross* material I have been unable to find any material referable to this species. The authors give a long discussion of the synonymy of this species in the paper last referred to in the synonymy given here.

Genus RHAPHIDOSCENE Vaughan Jennings, 1896.

Rhaphidoscene Vaughan Jennings (type, *R. conica* Vaughan Jennings) Journ. Linn. Soc., vol. 25, 1896, p. 320.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 225.—Heron-Allen and Earland, Trans. Zool. Soc., vol. 20, 1915, p. 608.

Description.—Test attached, conical, base broad extending to a point at the outer end; chamber single; wall composed of sponge spicules arranged lengthwise of the test with a cement of white calcareous amorphous material; aperture indistinct, at the outer pointed end of the test.

The single species of the genus seems to be largely limited to cold waters of the North Atlantic, although Heron-Allen and Earland place in the same category a form found by them in the Kerimba Archipelago off the southwestern coast of Africa.

RHAPHIDOSCENE CONICA Vaughan Jennings.

Plate 17.

Rhaphidoscene conica Vaughan Jennings, Journ. Linn. Soc. London, vol. 25, 1896, pp. 320–321, pl. 10.—Chapman, The Foraminifera, London, 1902, p. 117, pl. 5, fig. H.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 226, fig. 50 (in text).—Heron-Allen and Earland, Trans. Zool. Soc., London, vol. 20, 1915, p. 608, pl. 46, figs. 16, 17 [?].

Description.—Test attached, conical, basal end broad, tapering to the pointed apertural end, single chambered; wall composed of long, acerose sponge spicules extending nearly the whole length of the test laid longitudinally side by side, interspersed with some fine sand grains and cement; color whitish; aperture not definite but probably at the outer pointed end.

Diameter, 1 mm.

Distribution.—The type station for this species is one of the *Porcupine* dredgings in the Faroe Channel in 440 fathoms, attached to the test of *Botellina labyrinthica*. Heron-Allen and Earland record the occurrence of a specimen from haul 119, *Goldseeker*, also in the Faroe Channel, 60° 34′ N., 4° 32′ W., depth 965 meters, attached to a pebble. This specimen was much larger than the type, "being

3 mm. in diameter, the cone much depressed and exhibiting a well-marked apical aperture closed in with fine sand grains. The walls of the cone in the *Goldseeker* specimen are entirely composed of acerate sponge spicules laid regularly side by side as in the type."

The same authors refer a specimen attached to *Zostera* from shallow water in the Kerimba Archipelago to this species. The arrangement of the spicules is very different in their figured specimen, and the materials are differently arranged. This latter may be a new genus and species of shallow-water habitat in tropical regions.

The following notes are from the original paper of Vaughan Jennings:

The spicular structure is in this case the more remarkable since there can be no question as to the abundance of other material at hand. The *Botellina* shells are constructed of coarse sand grains, and by far the greater part of the dredging consists of similar material. In fact, the contrast between these delicate spicular cones and the coarse sandy structure of the organism on which they rest is one of the most striking instances I know of the selective power in Protozoa.

At the base the shell is fixed to the rough surface of the *Botellina* by a small amount of a white, doubtless calcareous, cement; but in the walls there is very little interstitial matter.

In the dry specimen the apex of the cone is closed; but I should think it probable that in the living condition the spicules were more or less mobile, so as to separate to some extent at the top, and allow a free passage of the protoplasm to the exterior.

Such a species as this brings to mind at once the question of how it may be formed. If *Botellina* is a comparatively fixed form, any attached specimen on it would have little opportunity of gathering such complete spicules as the test of *Rhaphidoscene conica* shows in sufficient quantity to produce such a test. May it not be that the individual exists for a time like a plasmodium or other naked protoplasm capable of free movement, and therefore of ingesting spicules, until it finally settles down and uses these spicules in the construction of a definitely placed, attached test? This would not be so unlike the process adopted by some of the other Rhizopods in the construction of their test.

Genus SACCAMMINA Carpenter, 1869.

Saccammina (type, *S. sphaerica* M. Sars) G. O. Sars, Förh. Selsk. Christiania, 1868 (1869), p. 248 (*nomen nudum*).—Carpenter, Ann. Mag. Nat. Hist., ser. 4, vol. 4, 1869, p. 289.—Bütschli, in Bronn, Klassen und Ordnungen Thierreichs, vol. 1, 1880, p. 195.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 252.—Rhumbler, Zeitschr. Wiss. Zool., vol. 57, 1894, p. 462.—Eimer and Fickert (part), Zeitschr. Wiss. Zool., vol. 65, 1899, p. 671.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 242.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 38.—Rhumbler, Foram. Plankton Exped., Teil 2, 1913, p. 375.

Description.—Test typically free, sometimes attached, consisting of a single chamber or of several spherical chambers with distinct apertures, usually one for each chamber; wall composed of sand grains finely cemented by a yellowish or brownish cement; aperture circular, usually with a short neck.

Rhumbler has argued that *Psammosphaera* is the immature form of this genus, but Heron-Allen and Earland seem to have shown conclusively that the two are distinct.

SACCAMMINA SPHAERICA G. O. Sars.

Plate 16, figs. 4, 5; plate 19, figs. 2–5.

Saccammina sphaerica (M. Sars, *nomen nudum*, Förh. Selsk. Christiania, 1868 (1869), p. 248), G. O. Sars, Förh. Selsk. Christiania, 1871, p. 250. Carpenter, The Microscope, ed. 5, 1875, p. 532, figs. 272*a–c*.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 253, pl. 18, figs. 11–17.—Egger, Abh. Bay. Akad. Wiss. München, vol. 18, 1893, p. 254, pl. 4, fig. 8.—Rhumbler, Zeitschr. Wiss. Zool., vol. 57, 1894, pp. 433–619, pls. 21–25.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 13, pl. 3, figs. 16–18.—Chapman, Proc. Zool. Soc. London, 1895, p. 13.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 26.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 269, pl. 9, fig. 2.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 243, figs. 78*a–d* (in text).—Dakin, Rep. Ceylon Pearl Oyster Fish., vol. 5, 1906, p. 232.—Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, pl. 34, figs. 5, 5*a*.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 39, figs. 33–36 (in text).—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 40; Journ. Roy. Micr. Soc., 1913, p. 15, pl. 1, figs. 1–19, pl. 2, figs. 1, 2.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1,000.

Description.—Test typically free, rarely attached, spherical or pyriform; consisting of a single chamber without divisions, wall of fairly coarse sand grains, firmly cemented, interior smooth, exterior usually smooth, in specimens with very large sand grains and small test somewhat roughened, but the interstices usually partly at least filled by cement; aperture single, circular, with a very slight neck protruding from the surface of the test; color variable, from light grayish white to nearly black.

Diameter, 1–3.5 mm.

Distribution.—This seems to be universally distributed in the deeper waters of all the oceans, being recorded from all the great ocean basins, and is known from the Antarctic Ice Barrier to the Arctic off Greenland and Franz Joseph Land. On the eastern side of the Atlantic it is recorded from Norway, North Sea, about the British Isles, Faroe Channel, Bay of Biscay, and off the coast of Africa. On the western side it is recorded by Flint from off the coast of Brazil, *Albatross* D2760, in 1,019 fathoms.

In the *Albatross* dredgings which I have examined the species occurs at numerous stations from Nova Scotia southward along the coast and in the Gulf of Mexico. These stations range in depth from 82 to 2,045 fathoms and bottom temperatures from 34.4° to 40.7° F.

The development of *S. sphaerica* has been noted by Heron-Allen and Earland. The smallest specimens are usually pear shaped and the material of the test comparatively coarser and the aperture a mere chink at the protuberant end. Two forms are usually ob-

served, one in which the particles of the test are small and the test smoothly finished, the other using larger grains and consequently a rougher surfaced test. As the specimen develops it becomes more nearly spherical and the nipplelike apertural neck becomes apparent.

A variety of this species from the Faroe Channel is noted. It has a very rough test using "large tetractinellid spicules as a support-framework for the shell." Usually these have no protuberant neck, "the aperture being usually an irregular and large opening, nearly flush with the shell wall and lined with pale cement." This variety, apparently worthy of varietal rank, may be known as *Saccammina sphaerica*, var. *anglica*, new variety. It is plate 1, figures 15–19, of Heron-Allen and Earland's paper in the Journal of the Royal Microscopical Society for 1913.

Saccammina sphaerica—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9843	U.S.N.M.	10+	D2003....	37 16 30 N.; 74 20 36 W.	641	.....	.....	Common.
9844	U.S.N.M.	2	D2018....	37 12 22 N.; 74 20 04 W.	788	39	bu. m.....	Few.
9845	U.S.N.M.	1	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Rare.
9846	U.S.N.M.	1	D2038....	38 30 30 N.; 69 08 35 W.	2,033	.....	glob. oz.....	Rare.
9847	U.S.N.M.	3	D2043....	39 49 00 N.; 68 28 30 W.	1,467	38.5	glob. oz.....	Few.
9848	U.S.N.M.	2	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s.....	Rare.
9849	U.S.N.M.	3	D2116....	35 45 23 N.; 74 31 25 W.	888	39	bu. m. fne. s.	Few.
9850	U.S.N.M.	8	D2171....	37 59 30 N.; 73 48 40 W.	444	39.5	gn. m.....	Common.
9851	U.S.N.M.	1	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Rare.
9852	U.S.N.M.	1	D2205....	39 35 00 N.; 71 18 45 W.	1,073	38.1	gy. oz.....	Rare.
9853	U.S.N.M.	6	D2212....	39 59 30 N.; 70 30 45 W.	428	40	gn. m.....	Few.
9428	U.S.N.M.	3	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Few.
9429	U.S.N.M.	2	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Few.
9430	U.S.N.M.	3	D2228....	37 25 00 N.; 73 06 00 W.	1,582	36.8	br. m.....	Few.
9431	U.S.N.M.	1	D2231....	38 29 00 N.; 73 09 00 W.	965	36.8	gy. oz.....	Rare.
9432	U.S.N.M.	2	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Rare.
9854	U.S.N.M.	1	D2262....	39 54 45 N.; 69 29 45 W.	250	41.6	gn. m. s.....	Rare.
9855	U.S.N.M.	1	D2335....	23 10 39 N.; 82 20 21 W.	204	.....	.....	Rare.
9856	U.S.N.M.	2	D2385....	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Rare.
9857	U.S.N.M.	1	D2392....	28 47 30 N.; 87 27 00 W.	724	40.7	br. gy. m....	Rare.
9433	U.S.N.M.	10+	D2425....	36 20 24 N.; 74 46 30 W.	119	51.5	dk. gy. m. fne. s.	Common.
9434	U.S.N.M.	1	D2504....	44 23 00 N.; 61 22 45 W.	82	40.6	bk. m. g.....	Rare.
9435	U.S.N.M.	4	D2531....	40 42 00 N.; 66 33 00 W.	852	34.4	gy. m.....	Few.
9436	U.S.N.M.	2	D2547....	39 54 30 N.; 70 20 00 W.	390	39.6	gn. m.....	Few.
9437	U.S.N.M.	10+	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Common.
9438	U.S.N.M.	3	D2552....	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.....	Few.
9439	U.S.N.M.	1	D2562....	39 15 30 N.; 71 25 00 W.	1,434	37.3	gy. oz.....	Rare.
9440	U.S.N.M.	1	D2581....	39 43 00 N.; 71 34 00 W.	394	.....	gn. m.....	Rare.
9858	U.S.N.M.	4	D2677....	32 39 00 N.; 76 50 30 W.	478	39.3	gn. m.....	Few.
9441	U.S.N.M.	5	H79.....	14 20 30 N.; 63 10 00 W.	821	.....	co. s. sh. for.	Few.
9442	U.S.N.M.	1	H133.....	11 33 20 N.; 66 19 00 W.	533	.....	gy. m. for...	Rare.
6268	U.S.N.M.	.....	.....	Lofloden Islands.....	.....	.....	.....	.....
			Fish Hawk					
9859	U.S.N.M.	10+	949	.....	.....	.....	.....	Common.

SACCAMMINA SOCIALIS H. B. Brady.

Saccammina socialis H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 255, pl. 18, figs. 18, 19.—Chapman, Proc. Zool. Soc. London, 1895, p. 13.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 244, fig. 79 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 40, figs. 37, 38.—Rhumbler, Foram, Plankton-Exped., pt. 1, 1911, pl. 1, fig. 10*a*, *b*; pt. 2, 1913, p. 376.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1000.

Saccammina consociata Flint, Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 269, pl. 9, fig. 3.

The following extracts are taken from descriptions by earlier authors:

Test consisting of several independent arenaceous chambers, individually spherical or subspherical in shape and of nearly even size, attached to each other by their outer surfaces, but without stoloniferous intercommunication, each chamber having its own external aperture. Spheres seldom more than six or eight in number, and usually arranged with more or less regularity. Texture finely sandy, nearly smooth externally. Diameter of the individual chambers, one-thirtieth of an inch (0.8 mm.) or less.—(H. B. Brady.)

Free or adherent, subglobular; surface coarse and rough; walls thin, composed of rather coarse sand mixed with sponge spicules; color a rich reddish brown; orifices one or several, at the end of long slender tubes. Generally united into colonies, either in straight series, or curved, or confused, connected by stoloniferous tubes. Diameter of individual tests, 0.4 to 0.8 mm. (one-sixtieth to one-thirtieth inch).—(Flint.)

Distribution.—The records for this species are very few. North Atlantic, south of Rockall Bank, 1,263 fathoms (Brady); Faroe Channel (Pearcey); off Bahia, Brazil (Flint); Antarctic (Pearcey); North Pacific (Brady).

I have seen material only from *Albatross* D2760, off Bahia, Brazil, 1,019 fathoms, the stations recorded by Flint for *S. consociata* (U.S.N.M. No. 9860).

Both descriptions are given, that of *S. socialis* H. B. Brady and *S. consociata* Flint. The two agree very closely except in the matter of stoloniferous connections, which do not appear to be definite in the material I have seen. Therefore I have brought the two together, although larger series of material may show real differences.

SACCAMMINA MINUTA Rhumbler.

Plate 20, fig. 5.

Saccammina minuta Rhumbler, Foram. Plankton-Exped., pt. 1, 1911, pl. 1, figs. 8, 9; pt. 2, 1913, p. 375.

Description.—Test free or fixed, generally spherical, when fixed the lower side flattened, aperture often represented by a short tube coming out between the sand grains, usually inconspicuous.

Diameter, 0.18–0.42 mm.

Distribution.—Rhumbler records this species from the Plankton-Expedition stations, off the Hebrides, in 2,275 meters, and near St. Vincent, 4,980 meters.

The figure is from Rhumbler

Genus PROTEONINA Williamson, 1858.

Proteonina Williamson (type, *P. fusiformis* Williamson), Recent Foraminifera of Great Britain, 1858, p. 1 (not *Proteonina* Terquem 1875).—Rhumbler, Arch. Prot., vol. 3, 1903, p. 244.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 40.—Rhumbler, Foram. Plankton Exped., pt. 2, 1913, p. 377.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1000.

Reophax (part) H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 51; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 289.—Bütschli, in Bronn, Klassen und Ordnungen Thierreichs, vol. 1, 1880, p. 199.

Reophax Rhumbler, Nachr. Köngl. Ges. Wiss. Göttingen, 1895, p. 82.
Difflugia Egger, Abh. Köngl. Bay. Akad. Wiss. München, vol. 18, 1895, p. 251 (not *Difflugia* Leclerc, 1815).
Saccammina (part) Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 671.

Description.—Test free, consisting of a single undivided chamber, flask shaped or fusiform with a single aperture, wall composed of coarse sand grains, mica flakes, or other foreign material, test usually broadest near the base and gradually tapering more or less evenly to the apertural end; aperture usually circular, with commonly a slight neck which in some species is prominent and extended.

The species described here of mica flakes is a new form of test for this group, although it is known in *Reophax, Psammosphaera,* etc.

PROTEONINA FUSIFORMIS Williamson.

Proteonina fusiformis Williamson, Recent Foraminifera of Great Britain, 1858, p. 1, pl. 1, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 248, fig. 84 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 41, fig. 39 (in text).—Rhumbler, Foram. Plankton-Exped., pt. 1, 1911, pl. 2, fig. 15; pt. 2, 1913, p. 379.
Reophax fusiformis H. B. Brady, Denkschr. Kongl. Akad. Wiss. Wien, vol. 43, pt. 2, 1882, p. 99; Rep. Voy. *Challenger,* Zoology, vol. 9, 1884, p. 290, pl. 30, figs. 7–11.—H. B. Brady, Parker, and Jones, Trans. Zool. Soc., vol. 12, 1888, p. 217, pl. 41, fig. 18.—Millett, Journ. Roy. Micr. Soc., 1899, p. 253, pl. 4, fig. 11.—Bagg, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 125.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, No. 64, 1913, p. 42.—Chapman, Zool. Results *Endeavour,* vol. 3, pt. 1, 1915, p. 15.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, 1916, p. 222.
Lituola fusiformis J. Wright, Rep. Belfast Club, 1876–77, Append., table.
Lituola nautiloidea, var. *scorpiurus* W. B. Carpenter, in Parker and Jones, Introduction to the Study of the Foraminifera, 1862, Append., p. 309.

Description.—Test free, fusiform, asymmetrical, chamber usually single, sometimes incompletely divided by projections of the wall; wall composed of coarse sand grains, rough on the exterior, firmly cemented; aperture terminal, circular.

Length, up to 1 mm.

Distribution.—Brady records this species from various stations about the British Isles and to the northward as far as 78° 40′ N. It occurs occasionally on the western side of the Atlantic, but not nearly as often as *P. difflugiformis.*

PROTEONINA DIFFLUGIFORMIS (H. B. Brady).

Plate 21, figs. 1, 2.

Reophax difflugiformis H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 51, pl. 4, figs. 3*a*, *b;* Denkschr. Akad. Wiss. Wien, vol. 43, pt. 2, 1882, p. 99; Proc. Roy. Soc. Edinburgh, vol. 11, 1882, p. 715; Rep. Voy. *Challenger,* Zoology, vol. 9, 1884, p. 289, pl. 30, figs. 2–4 (not 1, 5).—Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 26, pl. 6, figs. 196–198; Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 28.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 272, pl. 16, fig. 2.—Millett, Journ. Roy. Micr. Soc., 1899, p. 252.—Dakin, Rep. Ceylon Pearl Oyster Fisheries, vol. 5, 1906, p. 232.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, No. 64, 1913, p. 42, Trans. Zool. Soc. vol. 20, 1915, p. 612; Trans. Linn. Soc. London, vol. 11, 1916, p. 222; Journ. Roy. Micr. Soc., 1916, p. 40.

Saccammina difflugiformis Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 671.

Proteonina difflugiformis Rhumbler, Arch. Prot., vol. 3, 1903, p. 245, figs. 80*a*, *b* (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 42; figs. 40, 41 (in text).—Rhumbler, Foram. Plankton-Exped., pt. 1, 1911, pl. 2, figs. 7–14, pt. 2, 1913, p. 378.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1000.

Description.—Test free, consisting of a single elongate oval or pyriform chamber with a more or less distinct tubular neck usually tapering gradually from the body of the chamber, undivided; wall fairly thick, of sand grains of variable size, firmly cemented or in small specimens with an excess of cement and fairly smooth; aperture circular, simple, terminal.

Length, up to 0.75 mm.

Distribution.—The distribution of this simple species is so extensive that little detailed mention need be given. It is recorded both from the Arctic and to the Antarctic Circle, in shallow water from the coasts of Europe, common along our own Atlantic coast and from the Gulf of Mexico, off Brazil, and off the Falklands.

The shape is often irregular, due to the incorporation of a large sand grain at the side, and thus causing a very prominent angle at one side. The material varies greatly and with it the color of the specimen, the small ones often as noted by Heron-Allen and Earland[1] composed largely of ferruginous cement while in large specimens the cement is not noticed among the coarse sand grains. Rhumbler figures specimens made up almost entirely of the broken fragments of other foraminiferal tests, especially Globigerinae.

Proteonina difflugiformis—*material examined.*

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9739	U.S.N.M.	7	D2018....	37 12 22 N.; 74 20 04 W.	788	39	bu. m.....	Common.
9740	U.S.N.M.	2	D2093....	39 42 50 N.; 71 01 20 W.	1,000	39	s. m.....	Few.
9741	U.S.N.M.	10+	D2111....	35 09 50 N.; 74 57 40 W.	938	.....	gn. m.....	Common.
9742	U.S.N.M.	1	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s.....	Rare.
9743	U.S.N.M.	2	D2171....	37 59 30 N.; 73 48 40 W.	444	39.5	gn. m.....	Rare.
9744	U.S.N.M.	3	D2189....	39 49 30 N.; 70 26 00 W.	600	39.7	gn. m. s.....	Few.
9745	U.S.N.M.	2	D2203....	39 34 15 N.; 71 41 15 W.	728	38.9	gn. m. s.....	Few.
9746	U.S.N.M.	2	D2204....	39 30 30 N.; 71 44 30 W.	728	39.1	br. m.....	Rare.
9747	U.S.N.M.	1	D2205....	39 35 00 N.; 71 18 45 W.	1,073	38.1	gy. oz.....	Rare.
9748	U.S.N.M.	1	D2212....	39 59 30 N.; 70 30 45 W.	428	40	gn. m.....	Rare.
9749	U.S.N.M.	3	D2217....	39 47 20 N.; 69 34 15 W.	924	38.1	gy. m.....	Few.
9750	U.S.N.M.	2	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Rare.
9751	U.S.N.M.	10	D2262....	39 54 45 N.; 69 29 45 W.	250	41.6	gn. m. s.....	Common.
9752	U.S.N.M.	1	D2372....	29 15 30 N.; 85 29 30 W.	27	.....	g.....	Rare.
9753	U.S.N.M.	1	D2394....	28 38 30 N.; 87 02 00 W.	420	41.8	gn. m.....	Rare.
9385	U.S.N.M.	3	D2530....	40 53 30 N.; 66 24 00 W.	956	38.4	gy. oz.....	Few.
9386	U.S.N.M.	1	D2531....	40 42 00 N.; 66 33 00 W.	852	34.4	gy. m.....	Rare.
9387	U.S.N.M.	3	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Few.
9388	U.S.N.M.	1	D2552....	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.....	Rare.
9389	U.S.N.M.	2	D2562....	39 15 30 N.; 71 25 00 W.	1,434	37.3	gy. oz.....	Few.
9390	U.S.N.M.	2	D2568....	39 15 00 N.; 68 08 00 W.	1,781	36.9	gy. oz.....	Few.
9391	U.S.N.M.	1	D2581....	39 43 00 N.; 71 34 00 W.	394	.....	gn. m.....	Rare.
9354	U.S.N.M.	1	D2677....	32 39 00 N.; 76 50 30 W.	478	39.3	gn. m.....	Rare.
9755	U.S.N.M.	1	D2761....	15 39 00 N.; 38 32 54 W.	818	39	pter. oz.....	Rare.

[1] Proc. Roy. Irish Acad., vol. 31, 1913, p. 42.

PROTEONINA TESTACEA (Flint).

Plate 20, figs. 1–4.

Reophax difflugiformis H. B. Brady, var. *testacea* Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 273, pl. 16, fig. 1.

Proteonina difflugiformis-testacea Rhumbler, Arch. Prot., vol. 3, 1903, p. 247, fig. 81 (in text).

Description.—Test irregularly flask shaped, apertural end produced; wall composed of a single layer of empty tests of other foraminifera; interior rather neatly finished, exterior more or less irregular.

Length, up to 2 mm.

Distribution.—The type station for this species is *Albatross* D2234, in 810 fathoms, southward of Long Island. I have had material from this same station and from more than 20 stations from Georges Banks to Cape Hatteras, the Gulf of Mexico, and the Caribbean Sea.

It seems worthy of specific rank for it has very definite and constant characters.

Proteonina testacea—*material examined.*

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9756	U.S.N.M.	8	D2037....	38 53 00 N.; 69 23 30 W.	1,731	38	glob. oz.....	Common.
9757	U.S.N.M.	4	D2013....	39 49 00 N.; 68 28 30 W.	1,467	38.5	glob. oz.....	Common.
9758	U.S.N.M.	2	D2105....	37 50 00 N.; 73 03 50 W.	1,395	41	glob. oz.....	Rare.
9759	U.S.N.M.	1	D2110....	35 12 10 N.; 74 57 15 W.	516	40	bu. m.....	Rare.
9760	U.S.N.M.	1	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s....	Rare.
9761	U.S.N.M.	3	D2174....	38 15 00 N.; 72 03 00 W.	1,594	.....	gy. m.....	Few.
9762	U.S.N.M.	1	D2189....	39 49 30 N.; 70 26 00 W.	600	39.7	gn. m. s.....	Rare.
9763	U.S.N.M.	2	D2202....	39 38 00 N.; 71 39 45 W.	515	39.1	gn. m.....	Few.
9764	U.S.N.M.	1	D2212....	39 59 30 N.; 70 30 45 W.	428	40	gn. m.....	Few.
9392	U.S.N.M.	4	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Few.
9393	U.S.N.M.	1	D2222....	39 03 15 N.; 70 50 45 W.	1,537	36.9	gy. oz.....	Rare.
9765	U.S.N.M.	3	D2224....	36 16 30 N.; 68 21 00 W.	2,574	36.8	glob. oz.....	Rare.
9394	U.S.N.M.	2	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Few.
9395	U.S.N.M.	1	D2229....	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Rare.
9396	U.S.N.M.	4	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Few.
9397	U.S.N.M.	2	D2237....	39 12 17 N.; 72 09 30 W.	520	39.5	gn. m.....	Few.
9766	U.S.N.M.	6	D2377....	27 07 30 N.; 88 08 00 W.	210	67	gy. m.....	Few.
9398	U.S.N.M.	10+	D2399....	28 44 00 N.; 86 18 00 W.	196	51.6	gy. m.....	Common.
9399	U.S.N.M.	2	D2531....	40 42 00 N.; 66 33 00 W.	852	34.4	gy. m.....	Few.
9400	U.S.N.M.	2	D2682....	39 38 00 N.; 70 22 00 W.	1,004	.....	gn. m. s.....	Few.
9401	U.S.N.M.	2	D2714....	38 22 00 N.; 70 17 30 W.	1,825	.....	br. oz.....	Few.
9402	U.S.N.M.	1	D2751....	16 54 00 N.; 63 12 00 W.	687	40	bu. glob. oz.	Few.

PROTEONINA MICACEA, new species.

Plate 19, figs. 6, 7.

Description.—Test free, single chambered, flask shaped, slightly longer than wide; body portion ovate, with a short cylindrical neck at the apertural end, wall very thin, transparent or translucent, composed of thin mica scales rather firmly cemented together by their edges, the amount of cement used being very small: aperture roughly circular at the end of the cylindrical neck.

Diameter, from 0.25 to 0.80 mm.

Distribution.—Type-specimen from *Albatross* station D2262, in 250 fathoms (39° 54′ 45″ N.; 69° 29′ 45″ W.), bottom temperature

41.6° F.; bottom of green mud and sand. At this station the species was very abundant, the specimens all of the same sort except for minor variations due to the difference in shape and size of the mica scales. (Cat. No. 9768, U.S.N.M.)

In the selective power of this species to choose mica scales for its test it may be compared with *Psammosphaera bowmanni* Heron-Allen and Earland, and also to *Reophax scottii* Chaster, both of which use mica scales in the construction of the test. At first sight it was thought that these specimens from the *Albatross* material might be *P. bowmani*, but they are all typical *Proteonina*, with a definite aperture and a cylindrical neck.

Proteonina micacea—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9767	U.S.N.M.	1	D2018....	37 12 22 N.; 74 20 04 W.	788	39	bu. m.....	Rare.
9768	U.S.N.M.	10+	D2262....	39 54 45 N.; 69 29 45 W.	250	41.6	gn. m. s.....	Common.

PROTEONINA HELENAE Rhumbler.

Plate 20, figs. 6, 7.

Proteonina helenae Rhumbler, Foram. Plankton-Exped., pt. 1, 1911, pl. 2, figs. 16, 17; pt. 2, 1913, p. 380.

Description.—Test free, elongate, fusiform; body portion conical, tapering, the initial end generally bluntly pointed, gradually increasing in diameter to the base of the neck, where the body is strongly constricted and merges into the cylindrical neck, which is longer than wide and of fairly even diameter; wall composed of entire or broken tests of other foraminifera, especially Globigerinidae, rather neatly cemented, the outher surface being fairly smooth; aperture circular, fairly large.

Length, 0.7–1.0 mm.

Distribution.—Rhumbler describes this species from a station off St. Vincent in 4,980 meters.

PROTEONINA HYSTRIX (Egger).

Reophax hystrix Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 256, pl. 4, fig. 14.

Proteonina hystrix Rhumbler, Arch. Prot., vol. 3, 1903, p. 248, fig. 86 (in text).

Description.—Test free, somewhat compressed; wall composed of sand grains, with the outside ornamented with an abundance of sponge spicules, all pointing toward the aboral end; apertural end broad, the aperture consisting of a long slit without a definite neck.

Diameter, about 1 mm.

Distribution.—Egger described this species from a single specimen obtained off the Cape Verde Islands in 69 meters. Nothing further is known of the species.

PROTEONINA AMBLYSTOMA Rhumbler.

Proteonina amblystoma RHUMBLER, Foram. Plankton-Exped., pt. 1, 1911, pl. 2, fig. 6; pt. 2, 1913, p. 377.

Description.—Test free, elongate, subcylindrical, main portion or body of the test of about the same diameter as the neck; single chambered, body portion composed of small irregular sand grains; neck portion of larger grains more nearly uniform in size, apertural end nearly as wide as the body of the test.

Length, 0.576 mm.; breadth, 0.234 mm.

Distribution.—Rhumbler describes this species from a single specimen from off the Hebrides in 2,275 meters. The question may arise at once whether this single specimen may not be an abnormal individual of some already described species. It is noted here as a matter of record. I have seen no material referable to it.

Genus LAGENAMMINA Rhumbler, 1911.

Lagenammina RHUMBLER (type, *L. laguncula* Rhumbler), Foram. Plankton-Exped., pt. 1, 1911, pp. 92, 111; pt. 2, 1913, p. 374.

Description.—Test free, bottle shaped, with a pseudochitinous sublayer on which are laid quite thickly, but roughly, small foreign bodies. The presence of this sublayer distinguishes this genus from *Proteonina*, which does not have such a layer.

LAGENAMMINA LAGUNCULA Rhumbler.

Plate 19, fig. 8.

Lagenammina laguncula RHUMBLER, Foram. Plankton-Exped., pt. 1, 1911, pp. 92, 111, pl. 1, fig. 4; pt. 2, 1913, p. 375.

Description.—Test free, bottle shaped, pouch of the bottle oval, stretching out into a slender neck at the broader pole, which is half as long as the body part. The thin under layer shows through the interstices between the outer granules with a yellowish color.

Length, 160–170μ.

Distribution.—This species was described by Rhumbler from two North Atlantic stations in 1,524 and 2,400 meters.

Genus PILULINA W. B. Carpenter, 1870.

Pilulina W. B. CARPENTER (type, *P. jeffreysii* W. B. Carpenter) Descr. Cat. Objects Deep-Sea Dredging [1870], p. 5.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 244.—RHUMBLER, Arch. Prot., vol. 3, 1903, p. 249.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 43.

Description.—Test free, globular or ovate, consisting of a single undivided chamber; wall composed of felted sponge spicules and a slight amount of fine sand without cement, aperture elongate, with a somewhat depressed area about it.

The genus *Pilulina* based upon *P. jeffreysii* by Carpenter is rather rare, known hitherto from but two species, the type from the North Atlantic and a second species, *P. ovata*, which I described from the North Pacific. Where the species occur they are often in great numbers but the known areas of distribution are very limited.

PILULINA JEFFREYSII W. B. Carpenter.

Pilulina, species, W. B. Carpenter, Descr. Catal. Obj. Deep-Sea Dredging 1870, p. 5.

Pilulina jeffreysii W. B. Carpenter, The Microscope, ed. 5, 1875, p. 532, figs. *d*, *e*,; ed. 6, 1881, p. 560, figs. 319*d*, *e*.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 244, pl. 25, figs. 1–6.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 266, pl. 5.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 249, fig. 88.

Description.—Test free, subspherical, or occasionally oval; composed of a single chamber, undivided; wall comparatively thin, made up of long sponge spicules felted together, the interstices filled with broken spicules and a white amorphous material, probably siliceous; smooth both inside and outside; the spicules on the outside more or less longitudinally arranged; aperture an elongate slit, straight or more often doubly curved and S-shaped, with slightly raised lip.

Diameter, up to 3.5 mm.

Distribution.—Brady's specimens of this species were from three stations of the *Porcupine* dredgings south of the Rockall Bank, depths 1,476, 630, and 1,215 fathoms. Flint records the species from the North Atlantic without station. Apparently this is the extent of our recorded knowledge of this species. In the *Albatross* material I have examined it has occurred at the following stations: D2036 in 1,735 fathoms, bottom temperature 38° F.; D2096 in 1,451 fathoms, bottom temperature 37.5° F.; D2221 in 1,525 fathoms, bottom temperature 36.9° F.; and D2229 in 1,423 fathoms, bottom temperature 37.7° F. These stations are southward of Georges Banks. At the latter stations specimens were very abundant, several vials full being obtained from the material.

There apparently is little or no calcareous material used in the wall of the test of this species, the test being unaffected by acids. The peculiarity of its distribution is remarkable, for material was examined from numerous stations in this same region.

Pilulina jeffreysii—*material examined.*

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9712	U.S.N.M.	2	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Few.
9713	U.S.N.M.	10+	D2096....	39 22 20 N.; 70 52 20 W.	1,151	37.5	glob. oz.....	Abundant.
9925	U.S.N.M.	.....	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Abundant.
9537	U.S.N.M.	10+	D2229....	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Few.

Genus PELOSINA H. B. Brady, 1879.

Pelosina H. B. Brady (type, *P. variabilis* H. B. Brady), Quart. Journ. Micr. Sci., vol. 19, 1879, p. 30.—Bütschli, in Bronn, Klassen und Ordnungen Thierreichs, vol. 1, 1880, p. 194.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 235.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 238.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 45.—Rhumbler, Plankton-Exped., Foraminiferen, pt. 2, 1913, p. 374.

Description.—Test free, variously formed, rounded, cylindrical or irregularly elongate; wall usually thick, composed of mud with various foreign bodies included in the outer portions; interior with a thin, membranaceous, chitinous layer often extending out and forming the whole wall at the apertural end of some species; aperture typically single and terminal, occasionally multiple in *P. variabilis*.

Several species occur in the Atlantic, but only two, *P. variabilis* and *P. cylindrica*, are known from many stations.

PELOSINA VARIABILIS H. B. Brady.

Plate 22, figs. 1–4.

Pelosina variabilis H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 30, pl. 3, figs. 1–3; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 235, pl. 26, figs. 7–9.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 266, pl. 4, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 239, fig. 74 (in text).—Chapman, Trans. New Zealand Inst., vol. 38, 1905, p. 83.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 47, fig. 52 (in text).—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 218.

Description.—Test irregular, consisting of a single fusiform chamber or of two or three independent chambers, irregularly associated, but usually attached near the apertural end of the main chamber; wall thick, irregular but usually fairly smooth composed of fine mud with more or less irregularly placed foreign bodies at the surface; basal layer thin and membranaceous, chitinous, sometimes extended into a tubular neck at the apertural end; chamber in general conforming to the shape of the whole test; aperture terminal, circular; in some cases multiple and irregularly placed; color of test grayish.

Length, up to 20 mm.; diameter, usually not exceeding 2 mm.

Distribution.—This is by far the most common species of the genus in the Atlantic. In the *Challenger* Report Brady gives the following North Pacific records: Off Cumbrae, 50–60 fathoms (Robertson); west coast of Scotland and coast of Norway (Norman); off Franz Josef Land, 125 fathoms (Austro-Hungarian North Polar Expedition). It is also recorded from the Bay of Biscay (Rhumbler), off the west of Scotland (Heron-Allen and Earland), and from the Gulf of Mexico (Flint).

From the *Albatross* material I have had specimens from more than 20 stations ranging from Nova Scotia southward to the coast of South Carolina and 2 stations in the Gulf of Mexico eastward from the mouth of the Mississippi. These range in depth from 82

to 2,620 fathoms, the average being about 1,000 fathoms; bottom temperatures range from 34.4° to 40.6° F., with one station in the Gulf of Mexico in comparatively shallow water 51.6°. The average, however, is about 38° F.

Outside the Atlantic the species is recorded from the North and South Pacific (*Challenger*, Brady) and from off New Zealand (Chapman).

Pelosina variabilis—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9730	U.S.N.M.	1	D2018....	37 12 22 N.; 74 20 04 W.	788	39	bu. m.....	Rare.
9731	U.S.N.M.	1	D2042....	39 33 00 N.; 68 26 45 W.	1,555	38.5	glob. oz.....	Rare.
9732	U.S.N.M.	4	D2046....	40 02 49 N.; 68 49 00 W.	407	40	bu. m.....	Rare.
9733	U.S.N.M.	2	D2097....	37 56 20 N.; 70 57 30 W.	1,917	.....	glob. oz.....	Rare.
9734	U.S.N.M.	2	D2204....	39 30 30 N.; 71 44 30 W.	728	39.1	br. m.....	Rare.
9735	U.S.N.M.	2	D2205....	39 35 00 N.; 71 18 45 W.	1,073	38.1	gy. oz.....	Few.
9736	U.S.N.M.	2	D2112....	39 59 30 N.; 70 30 45 W.	428	40	gn. m.....	Rare.
9372	U.S.N.M.	2	D2222....	39 03 15 N.; 70 50 45 W.	1,537	36.9	gy. oz.....	Few.
9373	U.S.N.M.	1	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Rare.
9374	U.S.N.M.	1	D2228....	37 25 00 N 73 06 00 W.	1,582	36.8	br. m.....	Rare.
9737	U.S.N.M.	1	D2383....	28 32 00 N.; 88 06 00 W.	1,181	39.8	br. gy. m....	Rare.
9375	U.S.N.M.	3	D2399....	28 44 00 N.; 86 18 00 W.	196	51.6	gy. m.....	Rare.
9376	U.S.N.M.	1	D2504....	44 23 00 N.; 61 22 45 W.	82	40.6	bk. m. g.....	Few.
9377	U.S.N.M.	2	D2531....	40 42 00 N.; 60 33 00 W.	852	34.4	gy. m.....	Rare.
9379	U.S.N.M.	2	D2552....	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.....	Rare.
9378	U.S.N.M.	1	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Rare.
9380	U.S.N.M.	1	D2564....	39 22 00 N.; 71 23 30 W.	1,390	37.3	gy. oz.....	Rare.
9381	U.S.N.M.	1	D2566....	37 23 00 N.; 68 08 00 W.	2,620	36.4	gy. oz.....	Rare.
9382	U.S.N.M.	2	D2571....	40 09 30 N.; 67 09 00 W.	1,356	37.8	gy. glob. oz..	Rare.
9738	U.S.N.M.	1	D2678....	32 40 00 N.; 76 40 30 W.	731	38.7	lt. gy. oz....	Rare.
9383	U.S.N.M.	2	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Rare.
9384	U.S.N.M.	1	D2729....	36 36 00 N.; 74 32 00 W.	679	.....	dk. gy. m....	Rare.

PELOSINA CYLINDRICA H. B. Brady.

Plate 22, fig. 5.

Pelosina cylindrica H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 236, pl. 26, figs. 1–6.—Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 253, pl. 4, figs. 1, 2.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 239, fig. 72 (in text).—Chapman, Trans. New Zealand Inst., vol. 38, 1905, p. 83.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 46, figs. 50, 51 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1002.

Rhizammina indivisa Goës (part), Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 20.

Description.—Test free, elongate, subcylindrical, straight or slightly curved, diameter nearly uniform, ends rounded; wall thick, composed of loosely aggregated shell fragments or foraminiferal tests with a base of fine mudlike material, outside irregular, rough, interior smoothly finished, with a chitinous lining; color dark gray varying to almost white, according to the character of the wall; aperture at one end, circular.

Length, up to 15mm.; diameter, about 2mm.

Distribution.—Most of the records for this species are from deep water. The *Challenger* material except at one station was from over a thousand fathoms. Two of these stations were in the Atlantic, off

Gomera, Canary Islands, 620 fathoms, and off Sierra Leone, 1,750 fathoms. I have had material from the *Albatross* dredgings from 10 stations, 7 of these from the region south of Cape Cod from off Long Island to the region south of Georges Banks and the other three stations from the Gulf of Mexico off the mouth of the Mississippi and off Yucatan.

The species is also known from Antarctic Ice Barrier (Brady, *Challenger*), east coast of New Zealand (Brady, Chapman), from the North Pacific (Brady, Goës, Cushman), from the Indian Ocean west of Australia (Egger), and from the Antarctic (Pearcey).

The species is somewhat variable in the character of the test wall according to the bottom conditions from which it takes the material for its building purposes.

Pelosina cylindrica—*material examined.*

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9724	U.S.N.M.	2	D2042....	39 33 00 N.; 68 26 45 W.	1,555	38.5	glob. oz.....	Few.
9723	U.S.N.M.	1	D2052....	39 40 05 N.; 69 21 25 W.	1,098	45	glob. oz.....	Few.
9725	U.S.N.M.	1	D2150....	13 34 45 N.; 81 21 10 W.	382	45.75	wh. crs. s...	Rare.
9726	U.S.N.M.	1	D2204....	39 30 30 N.; 71 44 30 W.	728	39.1	br. m.....	Rare.
9727	U.S.N.M.	1	D2208....	39 33 00 N.; 71 16 15 W.	1,178	38.4	gn. m.....	Rare.
9728	U.S.N.M.	7	D2383....	28 32 00 N.; 88 06 00 W.	1,181	39.8	br. gn. m....	Common.
9729	U.S.N.M.	2	D2385....	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Few.
9369	U.S.N.M.	3	D2531....	40 42 00 N.; 66 33 00 W.	852	34.4	gy. m.....	Few.
9370	U.S.N.M.	2	D2581....	39 43 00 N.; 71 34 00 W.	394	.....	gn. m.....	Rare.
9371	U.S.N.M.	2	D2713....	38 20 00 N.; 70 08 30 W.	1,859	.....	br. oz.....	Rare.

PELOSINA ROTUNDATA H. B. Brady.

Plate 21, figs. 4–6.

Pelosina rotundata H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 31, pl. 3, figs. 4, 5; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 236, pl. 25, figs. 18–20.—Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 254, pl. 11, fig. 69.—Millett, Journ. Roy. Micr. Soc., 1899, p. 249, pl. 1, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 239, fig. 71 (in text).—Chapman, Trans. New Zealand Inst., vol. 38, 1905, p. 83.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 45, figs. 47–49 (in text).

Description.—Test flask shaped or pyriform with an elongated tubular neck, which is often membranaceous, of brownish, chitinous material, continuous with the lining of the test, remainder of the wall thick, composed of foraminiferal tests or other coarse material with a ground mass of fine mud loosely cemented, interior smoothly finished with a brownish, chitinous lining extended to the apertural neck, chamber small compared to the size of the test on account of the thick wall, undivided; aperture at the end of the tubular neck, rounded.

Diameter, up to 2 mm.

Distribution.—Records for this species are very rare. From the *Challenger* material Brady records it south of Rockall Bank in 640 fathoms and west of the Azores, 1,675 fathoms, and in the South Atlantic south of Pernambuco, Brazil, 350 fathoms. I have somewhat doubtful material from *Albatross* station D2212, in 428 fathoms, bottom temperature 40° southeast of Nantucket Shoals.

In other oceans it is known from the North Pacific (Brady) Malay Archipelago (Millett), Indian Ocean west of Australia (Egger) and off New Zealand (Chapman).

PELOSINA RECTA, new species.

Description.—Test free, elongate, the ends rounded, the sides nearly parallel, slightly tapering toward either end, compressed; wall of considerable thickness, composed for the most part of fine mud cemented together with a smooth surface, the interior also smooth, with a thin chitinous lining, somewhat yellowish in color; aperture at the end, rounded or somewhat elongate in the line of compression, without any trace of a neck, color grayish.

Length, up to 12 mm.; breadth, 3 mm.

Distribution.—Type-specimens from *Albatross* station D2084, in 1,290 fathoms (40°16′50″ N.; 67°05′15″ W.), bottom temperature 40°F. (Cat. No. 10001, U. S. N. M.). At this station several specimens all of this sort were found but none were found elsewhere. It is evidently a *Pelosina* from the construction of the test and its chitinous lining, but there is no neck and the opening is directly into the body of the chamber.

PELOSINA PARVA Rhumbler.

Plate 21, fig. 3.

Pelosina parva Rhumbler, Foram. Plankton-Exped., pt. 1, 1909 (1911), pl. 1, fig. 3; pt. 2, 1913, p. 374.

Description.—Test bottle shaped with lower end broad and rounded, bent more or less like a half moon, sand grains sparsely laid in the wall; single grains protrude sharply like short spines over the wall.

Length, up to 1 mm.

Distribution.—Locality near St. Vincent, 4980 (J. No. 139), few, mostly broken, specimens.

This new form is the smallest of the known species of the genus, in the point of size the nearest is *P. rotundata* Brady (1.8 mm.), which is distinguished from it by a sharply defined flask-shaped pouch. It reminds one of the larger (12 mm.) *P. cylindrica* Brady.

PELOSINA ARBORESCENS Pearcey.

Plate 23, figs. 1, 2.

Pelosina arborescens Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p 1001, pl. 1, figs. 1–5.

This form was described by Pearcey as follows:

Test vase shaped, elongate, subcylindrical, erect, smooth and unctous to the touch, more or less flexible in the living state, rounded at the base, gradually narrowing toward the superior extremity, which is drawn out into a slender main tubular chamber, somewhat dome shaped at its base.

From about one-third of the test upward a number of dichotomous tubular branches extend at irregular intervals with graceful curves. These branches open out into the main chamber. The wall at the base of each outgrowth is thicker and somewhat swollen, but after a short distance becomes more uniform in diameter. Walls of the main chamber thick, composed of fine mud deposited on a slender chitinous envelope extending to the terminal apertures of the branching tubes where it becomes quite thin and consists of little more than a membrane, so thin and soft that it readily collapses on drying.

Color vandyke brown. A few filamentous outgrowths come off from the outer wall of the extremity of the basal portion and appear in some cases to be tubular, but they are so fragile that they break off with the slightest manipulation. It is probable that these filaments serve to fix the test in an upright position in the deposit on the ocean floor.

Height of test, 1¼–2 inches (30–48 mm.) or more.

Distribution.—Pearcey records this species from the west coast of Scotland, 50–90 fathoms, sparingly in the deep water area of Loch Fyne, 100–107 fathoms; off coast of Norway (Norman); and doubtful specimens collected by the *Triton* in 640 fathoms in the Faroe Channel.

This is a most interesting species in many ways and is probably widely distributed, as Pearcey also records it from the Antarctic in deep water, 2,620 fathoms.

Genus HIPPOCREPINA Parker, 1870.

Hippocrepina Parker, in Dawson, Can. Nat., n. ser., vol. 5, 1870, p. 176 (type, *H. indivisa* Parker).—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 324.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 274.

Description.—Test free, consisting of a single, elongate, somewhat tapering, straight or slightly curved chamber, closed at the somewhat bluntly pointed proximal end, distal end broad and rounded, walls comparatively thin, of fine sand grains with a reddish-brown cement, grayish toward the distal end; aperture curved, narrow, or irregular, sometimes with a raised lip.

The genus seems to be rare but the records are rather widely scattered, Heron-Allen and Earland having described a species from the Kerimba Archipelago off the southwestern coast of Africa and the type-species known from the North Atlantic.

HIPPOCREPINA INDIVISA Parker.

Plate 23, figs. 3–7.

Hippocrepina indivisa Parker, in Dawson, Can. Nat., n. ser., vol. 5, 1870, p. 176, fig. 2.—Dawson, Amer. Journ. Sci., ser. 3, vol. 1, 1871, p. 206, fig. 2; Ann. Mag. Nat. Hist., ser. 4, vol. 7, 1871, p. 86, fig. 2.—H. B. Brady, Ann. Mag.

Nat. Hist., ser. 5, vol. 8, 1881, p. 407, pl. 21, figs. 3*a*, *b*, 4; Denkschr. k. Akad. Wiss. Wien, vol. 43, pt. 2, 1881 (1882), p. 100, pl. 2, figs. 3*a*, *b*, 4; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 325, pl. 26, figs. 10–14.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 28, pl. 6, figs. 216, 217.—Schlumberger, Mem. Soc. Zool. France, vol. 7, 1894, p. 253.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 274, fig. 124 (in text).—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 48, pl. 2, figs. 10, 11.

The original description was as follows:

Test free, monothalamous; elongate, straight, or somewhat curved; superior or oral end broad and rounded; inferior tapering to a blunt point and closed. Aperture a wide curved slit, often irregular, set in a raised collar in the center of the broad end of the test. Walls thin and finely arenaceous; color reddish brown at the point, lighter toward the oral end.

Length, about one twenty-fifth inch (1 mm.).

Distribution.—From the available records this seems to be a species of very cold waters. Its type station is Gaspé Bay, at the mouth of the St. Lawrence River, 16–20 fathoms (Dawson). It has been recorded from Holsteinborg Harbor, Greenland, 10 fathoms (Norman), and from soundings in the Matyushin Shar, Novaya Zembya, 10–15 fathoms (Brady), and from the Bay of Kola (Schlumberger). A single specimen is known from the British Isles in the Clare Island region, Ireland (Heron-Allen and Earland).

The only material I have seen at all referable to this species is from *Albatross* station D2018, off the eastern coast of the United States in 788 fathoms, bottom temperature 39.0° F. (U.S.N.M. No. 9681). Heron-Allen and Earland speak of their Clare Island specimen as "light gray in color and metallic in luster, due probably to the use of minute flakes of mica in the construction of the test."

The material I have from D2018 has also a very silvery surface, which was noted at the time the specimen was first found.

Genus TECHNITELLA Norman, 1878.

Technitella Norman (type, *T. legumen* Norman), Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 279.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 245.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 256.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 47.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1912, p. 382.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1002.

Description.—Test free, usually elongate, subcylindrical, fusiform or elongate oval, consisting of a single chamber; wall thin, composed of sponge spicules and fine sand, aperture rounded at the open end of the test.

As far as records show the various species of *Technitella* are widely scattered, but do not occur in any considerable numbers. As shown by Heron-Allen and Earland for *T. legumen* the test in that species at least is composed of two definite layers of spicules, those of the

exterior longitudinally placed, those of the interior transversely, giving a test of great rigidity.

TECHNITELLA LEGUMEN Norman.

Plate 9, figs. 1, 2; plate 10, fig. 1; plate 16, figs. 7, 8; plate 24, figs. 3–5; plate 26, fig. 5.

Technitella legumen Norman, Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 279, pl. 16, figs. 3, 4.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 246, pl. 25, figs. 8–12.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 14, pl. 3, figs. 20–27.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 256, fig. 96 (in text).—Dakin, Rep. Ceylon Pearl Oyster Fish., vol. 5, 1906, p. 232.—Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, pp. 406, 408, 412, pl. 34, fig. 10.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 47, fig. 53 (in text).—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1912, p. 382, pl. 5, figs. 1, 2; pl. 6, fig. 1; Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 37.—Chapman, Zool. Results *Endeavour*, vol. 3, pt. 1, 1915, p. 13.

Description.—Test free, usually elongate, pyriform, subcylindrical, fusiform or elongate oval, consisting of a single undivided chamber; wall thin, composed of sponge spicules and fine sand or amorphous white material, the spicules usually whole and of nearly the same size, those of the interior arranged transversely, those of the exterior longitudinally; aperture rounded, at the smaller end of the test, usually without a definite neck; color usually pure white, sometimes grayish.

Length, up to 2.5 mm.

Distribution.—Although widely distributed this species never seems to occur in any great numbers. The Atlantic records consist of the following: South of Bukken, Norway, 150–300 fathoms; 30 miles west of Valentia, Ireland, 112 fathoms (Norman); off Cumbrae, 60–65 fathoms (Robertson); North Sea and off Clare Island, Ireland (Heron-Allen and Earland); coast of Sweden (Goës); south of Pernambuco, Brazil, 350 fathoms; and east of Buenos Ayres, 1,900 fathoms (Brady). Outside the Atlantic it is known from off Christmas Harbor, Kerguelen Islands, 120 fathoms; off Sydney, New South Wales, 410 fathoms; north of the Society Islands, 2,350 fathoms; off the Fiji Islands and east of Japan, 1,875 fathoms (Brady); Gulf of Manaar (Dakin); and east of Tasmania, 1,122 fathoms (Chapman).

The specimens from the Malay Archipelago figured by Millett are referred to *Nouria harrisii* by Heron-Allen and Earland, who examined Millett's specimens.

The structure made by the two sets of spicules at right angles to one another is very strong. The details of the structure are given by Heron-Allen and Earland, but it is worthy of note that Goës in 1894 in his figures, especially figure 26, where the interior is shown, made out this same structure. In the figure referred to the spicules on the interior are horizontal, those of the exterior vertical.

In all the *Albatross* material I have examined the species has occurred at but three stations. These were of the typical elongate form figured by Brady. It is of interest that Flint does not record the species in his work on the *Albatross* material, showing with the few records I have been able to secure, that it is certainly rare on this side of the Atlantic so far as this material shows. The specimens from D2205 are very white and the material of which they are composed is very fine, at least on the surface, which is coated with a thin coating of fine amorphous material in most specimens. In only one of the specimens is there a coating of sand grains. Except in this last specimen, the spicules of the surface are entirely concealed by the fine white coating similar to that seen in *Pilulina jeffreysii*.

Technitella legumen—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9893	U.S.N.M.	1	D2052....	39 40 05 N.; 69 21 25 W.	1,098	45	glob. oz.....	Rare.
9894	U.S.N.M.	2	D2205....	39 35 00 N.; 71 18 45 W.	1,073	38.1	gy. oz.....	Rare.
9515	U.S.N.M.	2	D2559....	39 44 30 N., 70 30 45 W.	1,081	38.5	br. m.....	Rare.

TECHNITELLA MELO Norman.

Plate 16, fig. 6.

Technitella melo Norman Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 280, pl. 16, figs. 5, 6.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 246, pl. 25, figs. 7*a*, *b*.—Chapman, Proc. Zool. Soc. London, 1895, p. 12.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 256, figs. 95*a*, *b* (in text).—Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, pl. 34, fig. 9.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 48, fig. 54 (in text).

Description.—Test free, oval, slightly fusiform and tapering at the ends, with a single undivided chamber wall composed almost entirely of sponge spicules longitudinally placed and firmly united with a whitish cement; aperture small, terminal, circular, occasionally with a slight neck; color white or grayish.

Length, 1.4 mm.; diameter, 1 mm.

Distribution.—This species is even more rare than the preceding. In the Atlantic it is known from south of the Rockall Bank, 1,215 fathoms (Norman); Gulf of Gascony (Rhumbler); South Atlantic, *Challenger* station 344, off Ascension Island, 420 fathoms (Brady). Outside it is known from the Laccadives, Arabian Sea (Chapman), and *Challenger* station 237, in 1,875 fathoms, east of Japan (Brady).

This is a very scattered distribution, the small size and apparent rarity at any particular station being sufficient to account for the few records.

TECHNITELLA THOMPSONI Heron-Allen and Earland.

Plate 24, figs. 1, 2.

Technitella thompsoni Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, p. 403, pls. 31, 32, 34, fig. 8.

This species is described as follows:

Test free, subcylindrical, rounded and slightly tapering at one extremity and bluntly truncate at the other, consisting of a hollow chamber with composite walls built up entirely of echinoderm plates in a more or less perfect condition. The plates which overlap each other are fastened together without visible cement. No special aperture at either end of the test, the extremities being closed by means of similar plates set at an angle so that they resemble the incurving petals of a flower. Surface of the test neat and regular, and entirely devoid of extraneous matter, but the projecting edges of the flat (or slightly curved) plates used in the construction of the test give a somewhat irregular or serrate appearance to the outline. Hyaline-white in appearance, with slight iridescence when dry, due apparently to diffraction effects caused by the film of chitin with which the separate plates are probably fastened together.

Length, 1.8 mm.; breadth at truncate extremity, 0.350 mm., widening to 0.4 mm., and again diminishing somewhat rapidly to 0.250 mm. at the tapering extremity.

Distribution.—This very interesting species was first obtained by the *Goldseeker* in Moray Firth in 33 fathoms (station 8, 57° 55′ N.; 3° 20′ W.), and another specimen was later obtained in the North Sea in 39.71 fathoms (station 41C, 56° 35′ N.; 0° 10′ W.).

The selective power of this species in choosing only the plates of echinoderms from the mass of the bottom material is very interesting. As the selective power is so striking, some of the notes of the authors are here given:

As illustrating the skill of *Technitella thompsoni* and the great selective power exhibited by the animal, it may be stated that in neither of the dredgings in which it has been found do echinoderm plates, such as are used in its construction, abound. They occur in considerable numbers, as always is the case of shallow-water dredgings, but they form an infinitesimal percentage of the material as dredged, and their presence would be almost unobserved unless especially searched for.

Genus WEBBINELLA Rhumbler, 1903.

Webbina Jones, Parker, and H. B. Brady (type, *Webbina hemisphaerica* Jones, Parker, and H. B. Brady), Pal. Soc. Mon., 1865, p. 27 (not *Webbina* d'Orbigny, 1839).—H. B. Brady (part), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 348.—Chapman, Ann. Mag. Nat. Hist., ser. 6, vol. 18, 1896, p. 326.

Psammosphaera Eimer and Fickert (part), Zeitschr. Wiss. Zool., vol. 65, 1899, p. 671.

Webbinella Rhumbler (part), Arch. Prot., vol. 3, 1903, p. 228.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 50.

Description.—Test fixed, circular in outline, the central portion convex, the peripheral portion often forming a flattened flangelike rim about the central portion; chamber single, undivided, wall of medium thickness, composed of fine sand grains with a large proportion of cement rather smoothly finished both without and within;

aperture not apparent, the pseudopodia being thrust out at the basal portion of the test near the surface of attachment.

As now used this genus includes only the following species. In the genus *Ammolagena* is placed *A. clavata*, which seems to have practically no characters in common with *W. hemisphaerica*. *Ammolagena* has a definite second tubular chamber and a definite aperture.

WEBBINELLA HEMISPHAERICA (Jones, Parker, and H. B. Brady).

Plate 25, figs. 1–3.

Webbina hemisphaerica Jones, Parker, and H. B. Brady, Pal. Soc. Mon., 1865, p. 27, pl. 4, fig. 5.—Robertson, Rep. Brit. Ass., 1875, p. 189.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 350, pl. 41, fig. 11.—Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 266, pl. 14, figs. 1–3.—Cushman, Proc. Boston Soc. Nat. Hist., vol. 34, 1908, p. 24.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 53.

Placopsilina bulla Goës (part), Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 28, pl. 6, figs. 211, 212 (not figs. 213–215).

Psammosphaera hemisphaerica Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 671.

Webbinella hemisphaerica Rhumbler, Arch. Prot., vol. 3, 1903, p. 228, fig. 54 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 51, figs. 56*a*, *b* (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1003.

Description.—Test fixed, circular in outline when viewed from above, central portion convex, surrounded by a flattened flangelike border of varying width but sometimes entirely absent, chamber single, undivided, wall composed of fine sand grains with a very large proportion of cement, nearly smooth outside, smoothly finished within or occasionally roughened if there is an excess of sand; aperture indefinite, the pseudopodia being thrust through near the base just above the attachment; color usually grayish white, sometimes light brown.

Diameter, 0.5–1.5 mm.

Distribution.—Heron-Allen and Earland suggest that the apparent rarity of this species is due to the fact that it usually occurs in coarse shell sand or gravel containing few other Foraminifera. On the western side of the Atlantic such bottom conditions obtain where the species occurs. It has been noted from eight *Albatross* stations ranging in depth from 159 to 2,620 fathoms, with the average about 1,000 fathoms, bottom temperatures ranging from 36.4° at the deepest station to 47.4°F. at the shallowest. These *Albatross* stations are all south of Cape Cod, three southeast of Cape Cod, one off New Jersey, three off South Carolina, and the other in the Caribbean Sea north of Panama. I have recorded it from shallow water in the Woods Hole region. On the other side of the Atlantic it is known from the Faroe Channel, from the North Sea coast of England off Durham, from the Clare Island region, west of Ireland, and from off the Cape Verde Islands. Pearcey records it from the Antarctic in

2,621 fathoms, Heron-Allen from the Hauraki Gulf in New Zealand, and I have recorded it from the northwest Pacific.

It seems, therefore, to be a widely distributed species and probably overlooked, as Heron-Allen and Earland suggest.

Webbinella hemisphaerica—material examined.

Cat. No.	Coll. of—	No. of speci-mens.	Station.	Locality.	Depth in fath-oms.	Bot-tom tem-pera-ture.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9903	U.S.N.M.	1	D2048....	40 02 00 N.; 68 50 30 W.	547	39?	ers. m. g....	Rare.
9904	U.S.N.M.	1	D2105....	37 50 00 N.; 73 03 50 W.	1,917	.....	glob. oz.....	Rare.
9905	U.S.N.M.	1	D2150....	13 34 45 N.; 81 21 10 W.	382	45.75	wh. ers. s....	Rare.
9529	U.S.N.M.	2	D2314....	32 43 00 N.; 77 51 00 W.	159	47.4	ers. s. bk. sp. brk. sh.	Rare.
9530	U.S.N.M.	1	D2566....	37 23 00 N.; 68 08 00 W.	2,620	36.4	gy. oz.....	Rare.
9908	U.S.N.M.	10+	D2624....	32 36 00 N.; 77 29 15 W.	258	.....	gy. s. bk. sp.	Common.
9917	U.S.N.M.	10+	D2625....	32 35 00 N.; 77 30 00 W.	247	.....	gy. s. bk. sp.	Common.
9531	U.S.N.M.	1	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Rare.

Genus THOLOSINA Rhumbler, 1895.

Placopsilina H. B. Brady (type *Placopsilina bulla* (H. B. Brady)) (part), Quart. Journ. Micr. Soc., vol. 19, 1879, p. 51; vol. 21, 1881, p. 51; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 314.

Tholosina Rhumbler, Nachr. Köngl. Ges. Wiss. Göttingen, 1895, p. 82; Arch. Prot., vol. 3, 1903, p. 226.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 49.—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, No. 3, 1911, p. 8.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1002.

Pseudoplacopsilina Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 672.

Description.—Test attached, hemispherical, flattened on the side by which it is attached, chamber single, undivided; with pseudopodial extensions of the test along the surface of the attached surface or with the sides clear cut; wall of fine sand grains with a large proportion of calcareous cement; pseudopodial openings at base along attachment or at the end of irregular tubes running out from the base along the surface of attachment.

Of the two species *T. bulla* is usually attached to other arenaceous foraminifera in fairly deep water, while *T. vesicularis* is more often attached to pebbles or rocks in much shallower water.

THOLOSINA BULLA (H. B. Brady).

Plate 25, fig. 6.

Placopsilina bulla H. B. Brady, Quart. Journ. Micr. Soc., vol. 21, 1881, p. 51; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 315, pl. 35, figs. 16, 17.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 28, pl. 6, figs. 213–215 (not figs. 211, 212=*Ammolagena*); Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 25.—Millett, Journ. Roy. Micr. Soc., 1899, p. 361, pl. 5, fig. 11.

Tholosina bulla RHUMBLER, Nachr. Köngl. Ges. Wiss. Gottingen, 1895, p. 82.—KIAER, Norske Nordhavs Expedition, No. 25, 1899, p. 4.—RHUMBLER, Arch. Prot., vol. 3, 1903, p. 227, fig. 52 (in text).—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 49, fig. 55 (in text).—PEARCEY, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1002.

Pseudoplacopsilina bulla EIMER and FICKERT, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 672.

Description.—Test adherent, hemispherical or at least strongly convex, base flattened or irregular to conform to the surface to which it is attached; on a narrow base the test is usually somewhat elongate in the direction of the length of the attachment; chamber single, usually undivided; wall thick, composed of sand grains or fine amorphous material with much calcareous cement, outer surface somewhat uneven, interior fairly smooth aperture simple, circular elliptical or crescentiform, one or two, at either end near the base; color grayish white.

Diameter, not usually exceeding 1 mm.

Distribution.—Two Atlantic stations are given in the *Challenger* Report *Porcupine* station 19, in 1,366 fathoms, west of the North of Ireland, and from a *Challenger* station, in 1,900 fathoms, east of Buenos Aires. Goës records it from the Skagerack in 160 to 530 meters attached to *Rhabdammina* and from the Koster Islands at 18–140 meters attached to Fucus. Under this name, however, Goës includes, or at least his figures include *Ammolagena clavata*, so these records are somewhat obscure without recourse to original material. Kiaer records it from the subarctic region. The species occurs more abundantly on the Pacific coast of America, especially off the Central American and Mexican coasts (Goës, Cushman), and it is known from off the Pacific coast of Chile (Brady); Malay Archipelago (Millett), off Japan (Cushman), and from the Antarctic Pearcey).

When attached to a more or less regular surface of different color like the cylindrical reddish tubes of *Rhabdammina* this becomes a conspicuous object by its difference in color and changing the contour line of the surface to which it is attached. When attached to other light-colored bases, however, it is not easily seen. There is a tendency to division in some of the chambers.

In the *Albatross* material I have examined it has occurred at 20 stations between the Grand Banks and Cape Hatteras, depths ranging from 82 to 2,620 fathoms, bottom temperatures from 36.4° to 40.6° F. Most of these are attached to the *Rhabdammina* but are never in any considerable numbers at any station.

Tholosina bulla—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9895	U.S.N.M.	1	D2046....	40 02 49 N.; 68 49 00 W.	407	40	bu. m.....	Rare.
9896	U.S.N.M.	2	D2097....	37 56 20 N.; 70 57 30 W.	1,917	.....	glob. oz.....	Rare.
9897	U.S.N.M.	1	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fine s....	Rare.
9898	U.S.N.M.	2	D2171....	37 59 30 N.; 73 48 40 W.	444	39.5	gn. m.....	Rare.
9899	U.S.N.M.	1	D2172....	38 01 15 N.; 73 44 00 W.	568	39	gn. m.....	Rare.
9900	U.S.N.M.	3	D2187....	39 49 30 N.; 71 10 00 W.	420	37.7	gn. m. s....	Few.
9901	U.S.N.M.	2	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s....	Rare.
9902	U.S.N.M.	1	D2213....	39 58 30 N.; 70 30 00 W.	384	39.5	gn. m.....	Rare.
9518	U.S.N.M.	1	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Rare.
9519	U.S.N.M.	3	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Few.
9520	U.S.N.M.	4	D2237....	39 12 17 N.; 72 09 30 W.	520	39.5	gn. m.....	Few.
9521	U.S.N.M.	4	D2504....	44 23 00 N.; 61 22 45 W.	82	40.6	bk. m. g.....	Few.
9522	U.S.N.M.	10+	D2547....	39 54 30 N.; 70 20 00 W.	390	39.6	gn. m.....	Common.
9906	U.S.N.M.	1	D2533....	40 16 30 N.; 67 26 15 W.	828	38.7	br. oz.....	Rare.
9523	U.S.N.M.	1	D2562....	39 15 30 N.; 71 25 00 W.	1,434	37.3	gy. oz.....	Rare.
9524	U.S.N.M.	2	D2566....	37 23 00 N.; 68 08 00 W.	2,620	36.4	gy. oz.....	Few.
9525	U.S.N.M.	3	D2696....	46 53 30 N.; 45 05 30 W.	98	.....	gy. s. bk. sp.	Few.
9526	U.S.N.M.	3	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Few.
9527	U.S.N.M.	3	D2729....	36 36 00 N.; 74 32 00 W.	679	.....	dk. gy. m...	Few.
9528	U.S.N.M.	1	D2731....	36 45 00 N.; 74 28 00 W.	781	.....	gy. oz.....	Rare.

THOLOSINA VESICULARIS (H. B. Brady).

Placopsilina vesicularis H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 51, pl. 5, fig. 2; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 316, pl. 35, figs. 18, 19.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 47.

Tholosina vesicularis Rhumbler, Arch. Prot., vol. 3, 1903, p. 227, fig. 53 (in text).—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, No. 3, 1911, p. 8.

Description.—Test attached, lower side flattened or conforming to the surface to which it is attached, more or less irregular but in general a convex, low arching, subcircular chamber with the borders extending out into simple or branching generally tubular extensions for the pseudopodia, no other openings apparent; wall composed of sand grains embedded in an excess of cement, the grains usually angular and scattered so that they are separate from one another, surface smooth both without and within; chambers sometimes connected by the pseudopodal extensions or often crowded together, appearing to be a fusion or accidental placement rather than a direct association of several chambers of one individual; color light gray.

Diameter, up to 3 or 4 mm. without the pseudopodal extensions.

Distribution.—The material described by Brady came from three *Porcupine* stations between the northwest of Ireland and the Rockall Bank, depths 630, 1,215, and 1,443 fathoms. Beside these the *Challenger* obtained it east of Buenos Aires in 1,900 fathoms.

Awerinzew gives the following stations in the Siberian Arctic: North of New Siberian Islands, 38 meters, 77° 20′ 30″ N.; 138° 47′ E.; in 35 meters, 77° 10′ N.; 142° 48′ E.; and near Bennett Island, 42 meters, 76° 37′ N.; 147° 27′ E. These, it will be noted, are in cold, shallow water.

Heron-Allen and Earland in their Clare Island report give the following:

A few small and somewhat obscure specimens from station 27 [18 fathoms]. The occurrence of this species in such shallow water is very noticeable. The *Challenger* records, which, with one exception, were from the northwest of Ireland, range between 630 and 1,443 fathoms. The species is extremely abundant attached to stones and other foraminifera at many of the *Goldseeker* stations in the Shetland-Faroe Channel, often at depths considerably less than the *Porcupine* and *Challenger* records.

The foregoing is interesting in comparison with conditions on the western Atlantic coast. In ordinary dredgings, especially the fine sifted material, the species is not met with. However, in going over the rock material in the United States National Museum it became apparent that this is one of our most abundant species at least on our New England coast and on the various banks. The smaller glacial pebbles are often literally covered with masses of the tests of *T. vesicularis* and on the dark-colored rocks they stand out in beautiful contrast. In the *Speedwell*, *Fish Hawk*, and *Albatross* rock material the species was found as far south as off Cape Hatteras, depths ranging down to 1,309 fathoms, and northward as far as the material is represented to the north of Newfoundland.

In the northern waters it is very common at shallow depths. In my own dredgings I have found it very abundant in Casco Bay and Penobscot Bay on the coast of Maine in a few fathoms of water or, in fact, in a few feet below low tide wherever the rocks are not covered either with barnacles or with rock weed.

In spite of its apparent rarity elsewhere except in the colder waters about the British Isles, this is probably a very abundant species in cold water. Awerinzew's records in the Arctic tend to show that it is widely distributed and its apparent absence may be due to the fact that many students of the foraminifera have not had the opportunity to examine the coarser material from cold water.

Tholosina vesicularis—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9907	U.S.N.M.	10+	D2012	36 41 15 N.; 74 39 50 W.	66½	.....	.....	Common.
9914	U.S.N.M.	10+	D2074	41 43 00 N.; 65 21 50 W.	1,309	40	m. & st.	Common.
9918	U.S.N.M.	10+	D2109	35 14 20 N.; 74 59 10 W.	142	50.5	bu. m.	Common.
9913	U.S.N.M.	10+	D2156	47 29 00 N.; 52 18 00 W.	86	.....	g.	Common.
			Speedwell.					
9909	U.S.N.M.	10+	5	42 28 00 N.; 70 42 00 W.	33	45?	s. & m.	Common.
9915	U.S.N.M.	10+	75	Sandwich Point, Halifax Harbor.	.....	.....	fne. s. & r.	Common.
9911	U.S.N.M.	10+	161	Off Cape Ann, S. E.	54	.....	.....	Common.
9910 9923	U.S.N.M.	10+	181	42 24 00 N.; 70 36 00 W.	45	41.5	m.	Common.
9912	U.S.N.M.	10+	219	42 30 00 N.; 70 33 00 W.	32	55.5	rky.	Common.
9916	U.S.N.M.	10+	236	42 28 00 N.; 70 31 00 W.	28	48.5	rky. crs. s.	Common.
			Fish Hawk					
9920	U.S.N.M.	10+	776	.....	.....	.....	.....	Common.

Genus CRITHIONINA Goës, 1894.

Crithionina Goës (type, *C. mamilla* Goës) Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 14; Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 24.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 229.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 53.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 219.

Description.—Test spherical, lenticular or variously shaped, interior either labyrinthic or with a single chamber, apertures small and scattered or indistinct, wall thick, composed of sponge spicules or very fine sand, often chalky in appearance.

The especial development of this genus seems to be in the colder waters, especially in the North Atlantic, where in the colder waters it occurs in immense numbers. There are several species.

CRITHIONINA MAMILLA Goës.

Plate 27, figs. 1, 2; plate 28, fig. 12.

Crithionina mamilla Goës, Köngl. Svensk. Vet-Akad. Handl., vol. 25, No. 9, 1894, p. 15, pl. 3, figs. 34–36.—Schaudinn, Bergens Mus. Aarbog, 1894–95 (1896) No. 9, p. 4.—Millett, Journ. Roy. Micr. Soc., 1899, p. 250, pl. 4, fig. 2.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 230, fig. 56 (in text).—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1913, p. 9, pl. 3; Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 40; Trans. Zool. Soc. London, vol. 20, 1915, p. 616; Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 219.

Description.—Test free or attached, comparatively large, very thick walled, central chamber small, connected with the surface by irregular channels; wall composed of fine sandy material, loosely agglutinated, very thick, surface irregular but fairly smooth, interior more granular; apertures small and inconspicuous; color a dirty gray; outer surface often cracked in drying.

Diameter, up to 4 mm.

Distribution.—Goës originally described this species from the Skagerack in 106 meters attached to dead eelgrass, *Zostera*. Schaudinn records it from off Bergen, Norway. Heron-Allen and Earland record it from a large number of stations in the North Sea, Faroe Channel, and also in the Clare Island region and west of Scotland. It is a very common species along our coast from the Newfoundland Banks southward to Cape Hatteras.

Crithionina mamilla—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		° F.		
9636	U.S.N.M.	10+	D2084	40 16 50 N.; 67 05 15 W.	1,290	40	bu. m. s.....	Common.
9637	U.S.N.M.	5	D2096	39 22 20 N.; 70 52 20 W.	1,451	37.5	gy. oz.....	Few.
9533	U.S.N.M.	2	D2229	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Common.
9277	U.S.N.M.	8	D2544	40 01 45 N.; 70 24 00 W.	131	47.7	gn. s. bk. sp.	Few.
9534	U.S.N.M.	10+	D2571	40 09 30 N.; 67 09 00 W.	1,356	37.8	gy. glob. oz.	Common.
9535	U.S.N.M.	3	D2716	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Few.

CRITHIONINA PISUM Goës.

Plate 25, figs. 4, 5; plate 26, figs. 1–3.

Crithionina pisum Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 24, pl. 2, figs. 1, 2.—Millett, Journ. Roy. Micr. Soc., 1899, p. 250, pl. 4, fig. 3.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 266, pl. 6, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 230, fig. 57 (in text).—Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, pl. 34, figs. 6, 6*a*.

Crithionina abyssorum (part) Kiaer, Norske Nordhavs. Expedition, No. 25, 1899, p. 7, pl. 1, fig. 2 (not 1, 3, 4).

The original description is as follows:

Usually globular or subglobular, with comparatively smooth surface, often here and there provided with irregular impressions; wall thick, obsoletely sub-cavernous; traces of septa very obsolete; texture very loose, chalky, homogeneous; color whitish or gray.

Diameter, 1–3 mm.

Distribution.—The type station for this species is *Albatross* D2384, in 940 fathoms, in the northern part of the Gulf of Mexico. Flint records it from four *Albatross* stations south of Marthas Vineyard and Block Island (D2584, 2586, 2221, 2234), with a range of depth from 328 to 1,525 fathoms. In the *Albatross* material I have examined it has occurred sparingly from Georges Bank southward to Cape Hatteras.

Crithionina pisum—material examined.

Cat. No.	Coll of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		° F.		
9638	U.S.N.M.	10+	D2084....	40 16 50 N.; 67 05 15 W.	1,290	40	bu. m. s.....	Abundant.
9630	U.S.N.M.	2	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fine s....	Rare.
9631	U.S.N.M.	10+	D2172....	38 01 15 N.; 73 44 00 W.	568	39	gn. m.....	Common.
9632	U.S.N.M.	4	D2208....	39 33 00 N.; 71 16 15 W.	1,178	38.4	gn. m.....	Few.
9633	U.S.N.M.	10+	D2213....	39 58 30 N.; 70 30 00 W.	381	39.5	gn. m.....	Few.
9278	U.S.N.M.	6	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Rare.
9532	U.S.N.M.	10+	D2229....	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Few.
9279	U.S.N.M.	10+	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Common.
9280	U.S.N.M.	10+	D2237....	39 12 17 N.; 72 09 30 W.	520	39.5	gn. m.....	Few.
9634	U.S.N.M.	4	D2384....	28 45 00 N.; 88 15 30 W.	940	39.6	br. gy. m....	Few.
9281	U.S.N.M.	10+	D2504....	44 23 00 N.; 61 22 45 W.	82	40.6	bk. m. g.....	Common.
9289	U.S.N.M.	10+	D2547....	39 54 30 N.; 70 20 00 W.	390	39.6	gn. m.....	Few.
9282	U.S.N.M.	1	D2552....	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.....	Few.
9536	U.S.N.M.	7	D2571....	40 09 30 N.; 67 09 00 W.	1,356	37.8	gy. glob. oz..	Few.
9283	U.S.N.M.	10+	D2680....	39 50 00 N.; 70 26 00 W.	555	.....	.....	Few.
9284	U.S.N.M.	8	D2689....	39 42 00 N.; 71 15 30 W.	525	.....	gn. m.....	Few.
9285	U.S.N.M.	10+	D2714....	38 22 00 N.; 70 17 30 W.	1,825	.....	br. oz.....	Few.
9286	U.S.N.M.	1	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Rare.
9287	U.S.N.M.	10+	D2229....	36 36 00 N.; 74 32 00 W.	679	.....	dk. gy. m...	Few.
9288	U.S.N.M.	10	D2731....	36 45 00 N.; 74 28 00 W.	781	.....	gy. oz.....	Few.

CRITHIONINA PISUM Goës, var. HISPIDA Flint.

Plate 26, fig. 4.

Crithionina pisum Goës, var. *hispida* Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 267, pl. 6, fig. 2.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 230, fig. 61 (in text).—[?] Bagg, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 127.—Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, pl. 34, fig. 7.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 156, fig. 63 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1003.

Crithionina abyssorum (part) Kiaer, Norske Nordhavs Expedition, No. 25, 1899, p. 7, pl. 1, figs. 1, 3 (not 2, 4).

Description.—Variety differing from the typical in its smaller size and hispid surface made up of a great number of sponge spicules arranged nearly perpendicular to the outer surface.

Diameter, usually not exceeding 1 mm.

Distribution.—Flint gives four Atlantic stations for this variety, *Albatross* D2570, 2571, 2379, 2394, in 420–1,813 fathoms, two of them south of Georges Bank, the other two in the northern part of the Gulf of Mexico. Besides this material I have but one station to add, D2203, south of Georges Bank, in 705 fathoms, bottom temperature 38.9° F. Flint also records it from the coast of Oregon in the Pacific, D3080 in 93 fathoms.

Pearcey's notes in his Antarctic paper are as follows:

One specimen larger than the type attached to a rock fragment at station 420 (2,620 fathoms) [Antarctic]. Walls built of sponge spicules arranged perpendicularly in an amorphous siliceous cement and lined interiorly with a delicate chitinous membrane.

He also notes that the variety was taken by the *Triton* and *Knight Errant* Expeditions in the Faroe Channel and "recorded by me under the generic name of *Sorosphaera* sp., with several others of a similar character."

This is a rather definite variety and can hardly be mistaken for any other.

CRITHIONINA GRANUM Goës.

Plate 26, figs. 6, 7.

Crithionina granum Goës, Köngl. Svensk. Vet-Akad. Handl., vol. 25, No. 9, 1894, p. 15, pl. 3, figs. 28–33.—Schaudinn, Bergens Mus. Aaborg, 1894–95 (1896), No. 9, p. 4.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 231, fig. 58 (in text).

Description.—Test free, sublenticular, subglobose or oblong, occasionally roughly polygonal, slightly roughened; wall composed of sand grains with a few sponge spicules irregularly incorporated, loosely cemented, somewhat friable, interior with irregularly filled space, intercommunicating; apertures numerous, many scattered small ones with a few larger ones more or less grouped together.

Diameter, up to 2 mm.; length, up to 4 mm.

Distribution.—Goës described this species from the Skagerack in 300 meters. Schaudinn had it from off Bergen, Norway. Our western Atlantic material does not seem to be identical with this species.

CRITHIONINA GRANUM Goës, var. SUBSIMPLEX Goës.

Crithionina granum Goës, var. *subsimplex* Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 25.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 232.

According to Goës the form is described as follows:

Resembles in shape the type, but the walls are thin and the subdividing lamina of the cavity very much reduced, sometimes nearly obsolete.

Distribution.—Goës described this variety from the following stations: Caribbean Sea, 1,345 fathoms rare; *Albatross* H58, 1,345 fathoms, about 35 miles west off Santa Cruz, 17° 45′ N., 65° 35′ W., in globigerina ooze.

Genus THURAMMINA H. B. Brady, 1879.

Thurammina H. B. Brady (type, *T. papillata* H. B. Brady), Quart. Journ. Micr. Sci., vol. 19, 1879, p. 45.—Bütschli, in Bronn, Klassen und Ordnungen des Thierreichs, vol. 1, 1880, p. 202.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 321.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 57.

Thyrammina Rhumbler, Arch. Prot., vol. 3, 1903, p. 236.

Lituola W. B. Carpenter (part), The Microscope, ed. 5, 1875, p. 533.

Description.—Test typically free, usually nearly spherical, but in some species compressed, chamber single and undivided in typical species; wall thin, composed of fine sand with more or less chitin; apertures several to many at the end of nipplelike protuberances of the surface, occasionally wanting.

Several species occur in the Atlantic, some of them, so far as known, of restricted distribution.

THURAMMINA PAPILLATA H. B. Brady.

Plate 28, figs. 10, 11.

"Orbuline Lituola" W. B. Carpenter, The Microscope, ed. 5, 1875, p. 533, figs. 273*g*, *h*.

Thurammina papillata H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 45, pl. 5, figs. 4–8.—W. B. Carpenter, The Microscope, ed. 6, 1881, p. 561, figs. 320*g*, *h*.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 321, pl. 36, figs. 7–18.—Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 263, pl. 5, fig. 9.—Chapman, Proc. Zool. Soc. London, 1895, p. 17.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 25.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 278, pl. 22, fig. 1.—Earland, Journ. Quekett Micr. Club, ser. 2, vol. 9, 1905, p. 201, pl. 11, figs. 6, 7; pl. 14, figs. 1, 3.—Chapman and Howchin, Mem. geol. Surv. N. S. Wales, vol. 14, 1905, p. 9, pl. 2, fig. 13.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 58, fig. 66 (in text).—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 47.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1003.—Heron-Allen and Earland, Trans. Zool. Soc., vol. 20, 1915, p. 617.

Thyrammina papillata Rhumbler, Arch. Prot., vol. 3, 1903, p. 238, figs. 68*a–c* (in text.)

Description.—Test typically free, occasionally adherent, generally spherical, or when attached the lower surface flattened or otherwise modified to conform to the surface to which it is attached; usually consisting of a single undivided chamber but occasionally with one or more other chambers included in the outer one; wall very thin, composed of sand grains very neatly cemented with an abundance of reddish or yellowish brown cement; apertures numerous, irregularly scattered over the surface, situated at the ends of nipplelike projec-

tions, usually short but in some cases of considerable length, becoming tubular; color usually yellowish or reddish brown.

Diameter, up to 1.5 mm.

Distribution.—From the published records this seems to be a common species. It is known from the following Atlantic regions: North Sea and about the British Isles, Faroe Channel, 45–1,476 fathoms; at three *Challenger* stations north of the equator, 390–2,470 fathoms; six *Challenger* stations in the south Atlantic, 350–2,350 fathoms. From the western Atlantic Flint records it from *Albatross* stations D2225, south of Long Island; D2383 and 2385, Gulf of Mexico; D2570, southeast of Georges Bank, and 2760, off the coast of Brazil. These range in depth from 730 to 2,512 fathoms. I have seen the material from these stations and from D2037 in 1,731 fathoms southwestward from Georges Bank, bottom temperature 38° F., and H82 from the Caribbean Sea.

Outside the Atlantic it is known from the North and South Pacific and from the Antarctic and fossil specimens from the Jurassic have been assigned to this species.

Thurammina papillata—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		° F.		
9888	U.S.N.M.	1	D2037....	38 53 00 N.; 69 23 30 W.	1,731	38	glob. oz.....	Rare.
10036	U.S.N.M.	1	D2038....	38 30 30 N.; 69 08 25 W.	2,033	.....	glob. oz.....	Rare.
9517	U.S.N.M.	1	H82.....	13 29 00 N.; 62 42 40 W.	1,051	.....	for.m.bk.sp.	Rare.
6269	U.S.N.M.	1	Porcupine 31.	.....	1,360	.....	.....	.....

THURAMMINA ALBICANS H. B. Brady.

Plate 28, figs. 4–8.

Thurammina albicans H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 46; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 323, pl. 37, figs. 2–7.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 58, figs. 67–72 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1003.

Thyrammina albicans Rhumbler, Arch. Prot., vol. 3, 1903, p. 237, fig. 67 (in text).

Brady describes this species as follows:

Test spherical, or nearly so; with few, usually about six, mammillate orifices, equidistant and regularly disposed. Walls somewhat thicker than those of the type [*T. papillata*]; texture very finely arenaceous; color nearly white.

Diameter, about one-ninetieth inch (0.28 mm.).

Distribution.—The only Atlantic record for this species is the type station, *Challenger* 323, in 1,900 fathoms, off the South American coast in the latitude of Buenos Aires. It is known from a single station in the North Pacific in 2,050 fathoms (Brady, Cushman),

and Pearcey records two specimens from the Antarctic in 1,946 fathoms.

This small species is either very rare, as would seem from the records, or has been overlooked on account of its small size. All three stations are in deep water. It has not been met with in the North Atlantic material.

THURAMMINA CARIOSA Flint.

Plate 28, fig. 1.

Thurammina cariosa Flint, Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 278, pl. 22, fig. 2.

Thyrammina cariosa Rhumbler, Arch. Prot., vol. 3, 1903, p. 238, fig. 69 (in text).

The original description of this form is as follows:

Spherical; surface rough, as if eroded; walls rather thick, cavernous; cavity globular, smooth; apertures not tubular; color a dirty brown. Differs from *T. favosa* in the thicker walls and coarser structure, the eroded rather than reticulated surface, the cavernous walls and the nontubular orifices.

Diameter, about 1 mm. (one-twenty-fifth inch).

Distribution.—Flint described this species from two *Albatross* stations in the northern part of the Gulf of Mexico, D2385 in 420 and D2394 in 730 fathoms. The material from both of these I have seen and additional material from D2571 in 1,356 fathoms southeast of Georges Bank. The material from this last station is smaller and whiter than from the Gulf of Mexico but the surface is very similar.

THURAMMINA FAVOSA Flint.

Plate 28, figs. 2, 3.

Thurammina favosa Flint, Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 278, pl. 21, fig. 2.—Millett, Journ. Roy. Micr. Soc., 1904, p. 608, pl. 11, fig. 7.

Thyrammina favosa Rhumbler, Arch. Prot., vol. 3, 1903, p. 236, fig. 65 (in text).

This form is described as follows:

Test spherical; walls very thin, arenaceous, brown; surface ornamented with a network of thin prominent ridges extending uniformly over the whole test, forming hexagonal pits; cavity smooth; apertures numerous, small, at the end of short tubular processes from some of the points of junction of the ridges.

Diameter, about 0.8 mm. (one-thirtieth inch).

Distribution.—Flint described this species from two *Albatross* stations in the northern part of the Gulf of Mexico, D2374 in 26 and D2394 in 420 fathoms. I have found very typical material also from D2751 in 687 fathoms in the Carribbean Sea just west of the Leeward Islands. It also occurred at D2505 off Nova Scotia. These are very typical.

Millett records the species from several stations in the Malay Archipelago, but his figured specimen is very much more coarsely reticulate than the types and contain but a few facets. He makes the following note of his material: "* * * There is a certain amount of flexibility about the test reminiscent of the vegetable kingdom to

which possibly [it] may belong." It may be that this is after all not identical with the Gulf of Mexico and Carribbean species.

Pearcey refers an Antarctic form to this species as a variety.

Thurammina favosa—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
.....	U.S.N.M.	.....	D2374....	29 11 30 N.; 85 29 00 W.	26	.....	s. g. brk. sh.	Rare.
.....	U.S.N.M.	.....	D2394....	28 38 30 N.; 87 02 00 W.	420	41.8	gn. m.....	Rare.
9516	U.S.N.M.	1	D2505....	44 23 30 N.; 61 44 15 W.	93	42.3	dk. br. m...	Rare.
.....	U.S.N.M.	.....	D2751....	16 54 00 N.; 63 12 00 W.	687	40	bu. glob. oz..	Rare.

THURAMMINA COMPRESSA H. B. Brady.

Plate 28, fig. 9.

Thurammina compressa H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 46, pl. 5, fig. 9; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 324, pl. 37, fig. 1.
Thyrammina compressa Rhumbler, Arch. Prot., vol. 3, 1903, p. 238, fig. 70 (in text).

Brady describes this species as follows:

Test rounded, compressed, sublenticular; with numerous perforated mammillate protuberances arranged irregularly on the periphery. Walls thin, chitinoarenaceous; color dark brown.

Diameter, about one-fiftieth inch (0.5 mm.).

Distribution.—The type station, south of the Rockall Bank in 630 fathoms is the only record for this peculiar species. The following note as well as the figure and description is from Brady:

This also is a scarce modification of the type. It is distinguished by its membranous, only slightly arenaceous test, and its compressed almost lenticular contour. It is possible that the latter character may be in a measure accidental, and due to the partial collapse of the more or less flexible walls, as not unfrequently occurs in other chitino-arenaceous forms. * * * At the same time, the position of the mammilate orifices, on the peripheral margin, and not on the lateral faces of the test, makes it more likely that the natural form is retained by the dried specimens.

Subfamily 3. HYPERAMMININAE.

Genus HYPERAMMINA H. B. Brady, 1878.

Rhabdopleura? Dawson, Ann. Mag. Nat. Hist., ser. 4, vol. 7, 1871, p. 86.
Hyperammina H. B. Brady (type, *H. elongata* H. B. Brady), (part), Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 433.—Bütschli, in Bronn, Klassen und Ordnungen Thierreichs, vol. 1, 1880, p. 193.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 257.—Rhumbler, Nachr. köngl. Ges. Wiss. Göttingen, 1895, p. 82; Arch. Prot., vol. 3, 1903, p. 257.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 60.—Rhumbler, Plankton Exped., Foraminiferen, pt. 2, 1913, pp. 351, 381.
Hyperammina + *Bactrammina* Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, pp. 673, 675.

Description.—Test free, elongate, in general a simple cylindrical tube, straight or slightly curved with a swollen proloculum at the proximal end, distal end open and serving as the aperture; wall composed of sand grains, interior usually smoothly finished, exterior often rough, in some species the exterior smoothly finished and the cement in greater excess.

The genus as a rule seems to be very widely distributed but most abundantly represented in cool waters, temperature evidently having more control than depth, especially in the case of *H. subnodosa*.

HYPERAMMINA ELONGATA H. B. Brady.

Plate 29, fig. 4.

Hyperammina elongata H. B. Brady (part) Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 433, pl. 20, figs. 2*a*, *b*; Quart. Journ. Micr. Sci., vol. 19, 1879, p. 72; Denkschr. Akad. Wiss. Wien, vol. 42, 1881, p. 98.—Balkwill and Wright, Proc. Roy. Irish Acad., vol. 3, 1882, p. 546.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 257, pl. 23, figs. 4, 7 (not 9, 10).—Göes, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 17, pl. 4, figs. 56–58 (not 55).—Chapman, Proc. Zool. Soc. London, 1895, p. 13.—Göes, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 22.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 270, pl. 10, fig. 2 (part).—Kiaer, Norske Nordhavs Expedition, No. 25, 1899, p. 4.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 258, figs. 98*a*, *b* (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 60, figs. 73, 74 (in text).—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, No. 3, 1911, p. 11.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1004.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 220.

Bactrammina elongata Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 673.

Description.—Test elongate cylindrical, consisting of a subglobular proloculum and long, slender tubular second chamber, of lesser diameter than the proloculum; wall composed of sand grains firmly cemented, usually consisting of a single layer, exterior rough but the interior usually smoothly finished, cement yellowish brown; aperture at the distal end of the tube, circular without a lip or other modification; color dependent upon the constituent sand particles.

Diameter, about 0.5 mm; length, up to 8 mm.

Distribution.—This seems to be a very common and well-distributed species occurring throughout the Atlantic both in typical Globigerina-ooze and other types of bottom. It is recorded from the Arctic to the Antartic and is common off the coasts of Europe and on our own shores, the Atlantic coast, Gulf of Mexico, and Caribbean Sea, as well as off the South American coast.

Specimens with the proloculum intact are not so common as those which are broken and show only the tubular chamber, but in well-preserved material a number of complete specimens are usually found.

Hyperammina elongata—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9662	U.S.N.M.	2	D2035....	39 26 16 N.; 70 02 37 W.	1,362	.....	glob. oz.....	Few.
9663	U.S.N.M.	7	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Common.
9664	U.S.N.M.	3	D2038....	38 30 30 N.; 69 08 35 W.	2,033	.....	glob. oz.....	Few.
9665	U.S.N.M.	5	D2041....	39 22 50 N.; 68 25 00 W.	1,608	38	glob. oz.....	Few.
9666	U.S.N.M.	2	D2042....	39 33 00 N.; 68 26 45 W.	1,555	38.5	glob. oz.....	Few.
9667	U.S.N.M.	3	D2043....	39 49 00 N.; 68 28 30 W.	1,467	38.5	glob. oz.....	Few.
9668	U.S.N.M.	1	D2072....	41 53 00 N.; 65 35 00 W.	858	39	gy. m.....	Rare.
9669	U.S.N.M.	1	D2093....	39 42 50 N.; 71 01 20 W.	1,000	39	s. m.....	Rare.
9673	U.S.N.M.	2	D2105....	37 50 00 N.; 73 03 50 W.	1,395	41	glob. oz.....	Rare.
9674	U.S.N.M.	1	D2106....	37 41 20 N.; 73 03 20 W.	1,497	42.5	glob. oz.....	Rare.
9672	U.S.N.M.	2	D2174....	38 15 00 N.; 72 03 00 W.	1,594	.....	gy. m.....	Rare.
9671	U.S.N.M.	1	D2213....	39 58 30 N.; 70 30 00 W.	384	39.5	gn. m.....	Rare.
9670	U.S.N.M.	1	D2217....	39 47 20 N.; 69 34 15 W.	924	38.1	gy. m.....	Rare.
9316	U.S.N.M.	10	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Common.
9317	U.S.N.M.	1	D2222....	39 03 15 N.; 70 50 45 W.	1,537	36.9	gy. oz.....	Rare.
9318	U.S.N.M.	4	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Few.
9675	U.S.N.M.	1	D2262....	39 54 45 N.; 69 29 45 W.	250	41.6	gn. m. s.....	Rare.
9675	U.S.N.M.	6	D2372....	29 15 30 N.; 85 29 30 W.	27	.....	g.....	Few.
9319	U.S.N.M.	2	D2399....	28 44 00 N.; 86 18 00 W.	196	51.6	gy. m.....	Few.
9320	U.S.N.M.	1	D2531....	40 42 00 N.; 66 33 00 W.	852	34.4	gy. m.....	Rare.
9321	U.S.N.M.	1	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Rare.
9322	U.S.N.M.	1	D2564....	39 22 00 N.; 71 23 30 W.	1,390	37.3	gy. oz.....	Rare.
9323	U.S.N.M.	2	D2570....	39 54 00 N.; 67 05 30 W.	1,813	36.8	glob. oz.....	Rare.
9677	U.S.N.M.	3	D2677....	32 39 00 N.; 76 50 30 W.	478	39.3	gn. m.....	Rare.
9678	U.S.N.M.	2	D2679....	32 40 00 N.; 76 40 30 W.	782	38.6	lt. gy. oz.....	Rare.
9324	U.S.N.M.	1	D2706....	41 28 30 N.; 65 35 30 W.	1,188	.....	gy. oz. for...	Rare.
9325	U.S.N.M.	1	D2713....	38 20 00 N.; 70 08 30 W.	1,859	.....	br. oz.....	Rare.
9679	U.S.N.M.	1	D2760....	12 07 00 S.; 37 17 00 W.	1,019	39.5	br. co.....	Rare.
9680	U.S.N.M.	1	D2761....	15 39 00 S.; 38 32 54 W.	818	39	pter. oz.....	Rare.
9326	U.S.N.M.	1	H79.....	14 20 30 N.; 63 10 00 W.	821	.....	co. s. sh. for.	Rare.

HYPERAMMINA FRIABILIS H. B. Brady.

Plate 29, figs. 1–3.

Hyperammina elongata H. B. Brady (part), Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 433; Quart. Journ. Micr. Sci., vol. 19, 1879, p. 32.

Hyperammina friabilis H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 258, pl. 23, figs. 1–3, 5, 6.—Göes, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 17, pl. 4, fig. 59; Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 22.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 269, pl. 10, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 258, figs. 99*a*, *b* (in text).—Cushman, Bull. 71, U.S. Nat. Mus., pt. 1, 1910, p. 62, fig. 76 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1004.—Heron-Allen and Earland, Trans, Linn. Soc. London, vol. 11, pt. 13, 1916, p. 220.

Description.—Test elongate, subcylindrical, often somewhat tapering toward the apertural end, straight or nearly so, composed of a rather large globular proloculum and elongate cylindrical or slightly tapering second chamber slightly less in diameter than the proloculum; wall thick, loosely cemented especially on the exterior, rough, composed usually of fine sand, sometimes mixed with coarse sand particles, interior commonly smoother, with a yellowish-brown cement; aperture circular at the distal end of the second chamber.

Diameter, 2 mm.; length, up to 15 mm.

Distribution.—From the available records this is a widely distributed species, being recorded from about the British Isles and

Scandinavia, off the coast of South America and the Antarctic, the East Indies and North Pacific. In the *Albatross* material it is especially abundant in material from the region of Georges Bank southward to Cape Hatteras, although recorded from the Gulf of Mexico and the Caribbean Sea. The material I have had from these two latter regions, however, is not as typical as the east coast specimens. On our east coast depths range from 390 to 1,813 fathoms and bottom temperatures from 36.8° to 40.1° with one at 45.0° F.

There seems to be a tendency here to show both megalospheric and microspheric forms. The usual form is the megalospheric, where the proloculum is greater in diameter than the tubular second chamber, while in the rarer microspheric form the proloculum is hardly distinguishable from the tubular chamber in diameter and the whole test is somewhat larger.

Hyperammina friabilis—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9692	U.S.N.M.	1	D2018....	37 12 22 N.; 74 20 04 W.	788	39	bu. m.....	Rare.
9683	U.S.N.M.	10+	D2043....	39 49 00 N.; 68 28 30 W.	1,467	38.5	glob. oz.....	Common.
9684	U.S.N.M.	2	D2052....	39 40 05 N.; 69 21 25 W.	1,098	45	glob. oz.....	Few.
9685	U.S.N.M.	2	D2111....	35 09 50 N.; 74 57 40 W.	938	.....	gn. m.....	Few.
9686	U.S.N.M.	1	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s....	Rare.
9687	U.S.N.M.	4	D2150....	13 34 45 N.; 81 21 10 W.	380	45.75	wh. crs. s....	Few.
9688	U.S.N.M.	1	D2171....	37 59 30 N.; 73 48 40 W.	444	39.5	gn. m.....	Rare.
9689	U.S.N.M.	1	D2172....	38 01 15 N.; 73 41 00 W.	568	39	gn. m.....	Rare.
9690	U.S.N.M.	4	D2202....	39 38 00 N.; 71 39 45 W.	515	39.1	gn. m.....	Few.
9691	U.S.N.M.	4	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Few.
9337	U.S.N.M.	2	D2229....	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Rare.
9338	U.S.N.M.	1	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Rare.
9693	U.S.N.M.	5	D2377....	27 07 30 N.; 88 08 00 W.	210	67	gy. m.....	Few.
9694	U.S.N.M.	1	D2385....	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Rare.
9339	U.S.N.M.	1	D2399....	28 44 00 N.; 86 18 00 W.	196	51.6	gy. m.....	Rare.
9340	U.S.N.M.	3	D2547....	39 54 30 N.; 70 20 00 W.	390	39.6	gn. m.....	Few.
9341	U.S.N.M.	1	D2552....	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.....	Rare.
9342	U.S.N.M.	2	D2562....	39 15 30 N.; 71 25 00 W.	1,434	37.3	gy. oz.....	Rare.
9343	U.S.N.M.	10+	D2564....	39 22 00 N.; 71 23 30 W.	1,390	37.3	gy. oz.....	Common.
9344	U.S.N.M.	10	D2570....	39 54 00 N.; 67 05 30 W.	1,813	36.8	glob. oz.....	Common.
6254	U.S.N.M.	3	Porcupine 47	.....	540	.....	.....	

HYPERAMMINA SUBNODOSA H. B. Brady.

Plate 29, figs. 7, 8.

Rhabdopleura, species, G. W. Dawson, Ann. Mag. Nat. Hist., ser. 4, vol. 7, 1871, p. 86, fig. 7.

Hyperammina subnodosa H. B. Brady, Rep. Voy. *Challenger* Zoology, vol. 9, 1884, p. 259, pl. 23, figs. 11–14.—Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 255, pl. 4, fig. 32.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 16, pl. 3, figs. 42–53 (not 54).—Schlumberger, Mem. Soc. Zool. France, vol. 7, 1894, p. 254.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 259, figs. 100*a*, *b* (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 63, figs. 80*a*, *b* (in text).—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, No. 3, 1911, p. 12.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1004.

Description.—Test elongate, subcylinderical, larger than others of the genus, proloculum large, thick walled, tubular chamber of lesser diameter usually, irregularly constricted at intervals, walls very thick, coarsely arenaceous, somewhat roughened; interior smoother; aperture circular, at the distal end of the tube; color light grayish.

Length, up to 20 mm.

Distribution.—This is very evidently a cold-water species, being found under cold, deep water conditions and also in shallow water where temperatures are very low. In the North Pacific paper I noted that at the one shallow-water station at which the temperature even in September was but 30.4° F. In the Atlantic *Albatross* material the species has occurred at but few stations, five scattering stations from George Bank to the Virginia Capes in small numbers, depths 428 to 1,813 fathoms, bottom temperatures 36.° to 40° F. Farther north, however, at two stations, D2453, 82 fathoms, and D2458, 89 fathoms, in rather shallow water the temperatures were 29.7° and 29.5° F., respectively. At these stations in latitude 51° and 52° N. in the influence of the Greenland current and floating ice the species is extremely abundant, making up a large part of the bottom sample and could almost be called a "*Hyperammina subnodosa* bottom." Awerinzew records it from the Arctic north of Siberia and mentions that it is very characteristic of the Polar Sea. Pearcey records it from the Antarctic. It is recorded from off Greenland by Brady, who says that some of the finest specimens were from this region. He records it off Brazil and at other places, mostly in deep water.

Hyperammina subnodosa—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9703	U.S.N.M.	1	D2212.....	39 59 30 N.; 70 30 45 W.	428	40	gn. m.....	Rare.
9345	U.S.N.M.	10+	D2453.....	47 10 00 N.; 51 10 00 W.	82	29.7	gn. m. fne. s.	Abundant.
9346.	U.S.N.M.	10+	D2458.....	46 48 30 N.; 52 34 00 W.	89	29.5	s. gn. m.....	Abundant.
9347	U.S.N.M.	2	D2696.....	46 53 30 N.; 45 05 30 W.	98	.....	gy. s. bk. sp.	Few.
9348	U.S.N.M.	10	D2697.....	47 40 00 N.; 47 35 30 W.	206	.....	gn. m. bk. sp	Common.
9349	U.S.N.M.	5	D2729.....	36 36 00 N.; 74 32 00 W.	679	.....	dk. gy. m....	Rare.
9350	U.S.N.M.	3	D2731.....	36 45 00 N.; 74 28 00 W.	781	.....	gy. oz.....	Rare.
6255	U.S.N.M.	7	*Vaiorous* A	.....	20	.....	.....	

HYPERAMMINA LAEVIGATA J. Wright.

Plate 29, figs. 5, 6.

Hyperammina elongata H. B. Brady (part), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 257, pl. 23, figs. 9, 10 (not 3, 7, 8).—Göes, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 17, pl. 4, fig. 55 (not 56–58).—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 270, pl. 10, fig. 2 (in part).—Rhumbler. Arch. Prot., vol. 3, 1903, p. 258 (part).

Hyperammina elongata H. B. Brady, var. *laevigata* J. Wright, Proc. Roy. Irish Acad., ser. 3, vol. 1, 1891, p. 466, pl. 20, fig. 1.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 61, fig. 75 (in text).

Description.—Test elongate, subcylinderical, straight or more often slightly curved, proloculum ovoid or somewhat fusiform gradually passing into the tubular chamber which is of smaller diameter than the proloculum; wall smooth both without and within, composed of fine or occasional coarse sand grains with an abundance of cement; yellowish or reddish brown in color; aperture circular, at the open end of the tube.

Diameter, usually about 0.5 mm.; length, up to 10–12 mm.

Distribution.—As this species has usually been confused with *H. elongata*, its distribution is difficult to determine from the records. It was recorded as a variety by Wright from off Ireland and on the western side of the Atlantic occurs frequently from Georges Bank southward with a few specimens from the northern part of the Gulf of Mexico.

This is very different in all its specific characters from *H. elongata* and seems certainly worthy of specific rank.

Hyperammina laevigata—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9695	U.S.N.M.	2	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Rare.
9696	U.S.N.M.	5	D2041....	39 22 50 N.; 68 25 00 W.	1,608	38	glob. oz.....	Few.
9697	U.S.N.M.	1	D2042....	39 33 00 N.; 68 26 45 W.	1,555	38.5	glob. oz.....	Rare.
9698	U.S.N.M.	4	D2043....	39 49 00 N.; 68 28 30 W.	1,467	38 5	glob. oz.....	Rare.
9699	U.S.N.M.	3	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s....	Few.
9700	U.S.N.M.	1	D2217....	39 47 20 N.; 69 34 15 W.	924	38.1	gy. m.....	Rare.
9327	U.S.N.M.	10+	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Few.
9328	U.S.N.M.	2	D2222....	39 03 15 N.; 70 50 45 W.	1,537	36.9	gy. oz.....	Rare.
9701	U.S.N.M.	4	D2383....	28 32 00 N.; 88 06 00 W.	1,181	39.8	br. gn. m....	Few.
9330	U.S.N.M.	1	D2393....	28 43 00 N.; 87 14 30 W.	525	41.1	lt. gy. m....	Rare.
9329	U.S.N.M.	2	D2531....	40 42 00 N.; 66 33 00 W.	852	34.4	gy. m.....	Few.
9331	U.S.N.M.	1	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Rare.
9702	U.S.N.M.	1	D2679....	32 40 00 N.; 76 40 30 W.	782	38 6	lt. gy. oz....	Rare.
9332	U.S.N.M.	2	D2682....	39 38 00 N.; 70 22 00 W.	1,004	.....	gn. m. s.....	Rare.
9333	U.S.N.M.	1	D2684....	39 35 00 N.; 70 54 00 W.	1,106	.....	br. c. bk. sp.	Rare.
9334	U.S.N.M.	2	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Few.
9335	U.S.N.M.	1	1160....	17 39 00 N.; 65 44 00 W.	578	.....	co. s. for.....	Rare.
9336	U.S.N.M.	3	H82....	13 29 00 N.; 62 42 40 W.	1,051	.....	for. m. bk. sp.	Rare.

HYPERAMMINA DISTORTA, new species.

Description.—Test free, elongate, consisting of a bulbous proloculum, somewhat wider than long and greater in breadth than the following elongate second chamber, basal surface of the proloculum truncately rounded, surface smooth; second chamber more or less tortuous, with very numerous slight constrictions placed closely together, surface otherwise smooth; wall composed of sand grains of small size with an abundance of yellowish-brown cement; aperture formed by the open end of the tubular second chamber; color in general light yellowish brown, the proloculum darker in comparison than the second chamber, which toward the apertural end becomes a light yellowish gray.

Length, up to 4 mm.; breadth of the proloculum, about 0.5 mm.; of the tubular chamber, about 0.25 to 0.35 mm.

Distribution.—Type-specimens from *Albatross* station D2212, in 428 fathoms, south of Georges Bank (latitude 39° 59′ 30″ N.; longitude 70° 30′ 45″ W.), bottom temperature 40° F. (Cat. No. 9927, U.S.N.M.). The only other stations for this species are D2171, somewhat farther to the southwest, in 444 fathoms (latitude 37° 59′ 30″ N.; longitude 73° 48′ 40″ W.), bottom temperature 39.5 F.; D2262, in 250 fathoms, off Nantucket, and D2377, in the Gulf of Mexico.

The only species of this genus that at all resembles it closely is *H. laevigata*, from which our species differs in the shape of the proloculum and in the closely constricted and tortuous second chamber.

Hyperammina distorta—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9926	U.S.N.M.	3	D2171....	37 59 30 N.; 73 48 40 W.	444	39.5	gn. m.....	Few.
9927	U.S.N.M.	4	D2212....	39 59 30 N.; 70 30 45 W.	428	40	gn. m.....	Few.
9928	U.S.N.M.	3	D2262....	39 54 45 N.; 69 29 45 W.	250	41.6	gn. m. s....	Few.
9929	U.S.N.M.	1	D2377....	27 07 30 N.; 88 08 00 W.	210	67	gy. m.....	Rare.

Genus PSAMMATODENDRON Norman, 1881.

Psammatodendron Norman, MSS. in Brady, Denkschr. k. Akad. Wiss. Wien, vol. 43, 1881, p. 98 (type, *P. arborescens* Norman); Ann, Mag. Nat. Hist., ser. 5, vol. 8, 1881, p. 404.—Eimer and Fickert, Zietschr. Wiss. Zool., vol. 65, 1899, pp. 670, 673.

Hyperammina (part) H. B. Brady, Rep. Voy. *Challenger*, Zool., vol. 9. 1884, p. 262.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25. No. 9, 1894, p. 18.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 260.

Description,—Test attached by the bulbous proloculum, remainder of test free and erect, dichotomously branching, tubular, of even diameter throughout, wall arenaceous with ferruginous cement, open ends of the tubes serving as apertures.

PSAMMATODENDRON ARBORESCENS Norman.

Plate 30, figs. 1, 2.

Psammatodendron arborescens Norman, MSS. in H. B. Brady, Denkschr. k Akad. Wiss. Wien, vol. 43, 1881, p. 98; Ann. Mag. Nat. Hist., ser. 5, vol. 8; 1881, p. 404.—Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899; p. 670.

Hyperammina arborescens H. B. Brady, Rep Voy. *Challenger*, Zoology, vol. 9; 1884, p. 262, pl. 28, figs. 12, 13.—Wright, Proc. Belfast Nat. Field Club, 1884–85, App. IX, 1886, p. 319, pl. 26, fig. 1.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1884, p. 18, pl. 4, figs. 63, 64.—Chapman, Proc. Zool. Soc. London, 1895, p. 13.—Schaudinn, Bergens Mus. Aaborg, 1894–95, No. 9, p. 5.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 260, fig. 102 (in text).—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, No. 3, 1911, p. 11.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 220.

Description.—Test attached by the proloculum which is bulbous, remainder of test tubular, of nearly uniform diameter, irregularly dichotomously branching, wall composed of fine sand grains with an abundance of reddish-brown cement; apertures at the ends of the tubes.

Length, up to 5 mm.

Distribution.—On the eastern side of the Atlantic there are numerous records for this species. In the Arctic it is recorded from off Greenland, Iceland, Nova Zembla, Franz Joseph Land, and north of Siberia; off the coasts of Norway and Great Britain, and in the South Atlantic off Pernambuco, Brazil.

On the western side of the Atlantic this species seems to be either missing or overlooked. In the *Albatross* dredgings broken specimens have occurred which might have been assigned to this species but never sufficiently well preserved to make identification sure.

In Europe it usually occurs in comparatively shallow water, 200 fathoms being the shallowest. Off Brazil it was recorded at 350 fathoms.

Genus KALAMOPSIS de Folin, 1882.

Kalamopsis De Folin (type, *K. vaillanti* de Folin) Congrès Scient. Dax., 1882, p. 320; Act. Soc. Linn. Bordeaux, vol. 40 (ser. 4, vol. 10), 1886, p. 287.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 272.

Description.—Test with a subglobular proloculum, with a subcylindrical second tubular chamber more or less definitely constricted at intervals but the interior not completely septate; wall composed of sand grains and fragments of spicules with a large amount of calcareous (?) cement; open end of the tubular chamber serving as the aperture.

This genus was erected by de Folin for the following species:

KALAMOPSIS VAILLANTI de Folin.

Kalamopsis vaillanti De Folin, Congrès Scient. Dax., 1882, p. 320; Act. Soc. Linn. Bordeaux, vol. 40 (ser. 4, vol. 10), 1886, p. 288, pl. 8, figs. 12*a–c*.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 272, fig. 121 (in text).

Description.—Test with a bulbous, subglobular proloculum, followed by a second chamber, subcylindrical, tubular, more or less regularly constricted on the exterior, the portions thus formed subconical, the widest portion at the basal end; wall composed of sand grains, fragments of spicules, and large proportion of calcareous (?) cement; outside smooth except for occasional sand grains, interior smooth except at the constricted areas, where there are slight inwardly projecting portions of the wall slightly obstructing the tubular chamber at irregular intervals; aperture formed by the open end of the tube; color greenish gray.

Distribution.—This species was described by de Folin from the Gulf of Gascony and has not been recorded elsewhere.

According to the author's description and notes it seems allied to *Bathysiphon* in the general characters of the test.

Genus SACCORHIZA Eimer and Fickert, 1899.

Hyperammina H. B. Brady (part), Quart. Journ. Micr. Soc., vol. 19, 1879, p. 33; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 257.—Rhumbler, Nachr. Köngl. Ges. Wiss, Göttingen, 1895, p. 82; Arch. Prot., vol. 3, 1903, p. 257.

Saccorhiza Eimer, and Fickert (type, *Hyperammina ramosa* H. B. Brady), Zeitschr. Wiss. Zool., vol. 65, 1899, p. 670.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 64.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1004.

Description.—Test free, consisting of an ovoid proloculum with a branching tubular second chamber, wall composed of sand grains usually with the exterior roughened by projecting sponge spicules incorporated in the wall; apertures formed by the open ends of the tubular chamber.

The genus erected by Eimer and Fickert for this species differs from *Hyperammina* in its branching irregular habit and the typical inclusion of sponge spicules in the outer portion of the wall. It has a very wide distribution.

SACCORHIZA RAMOSA (H. B. Brady).

Plate 30, figs. 3, 4.

Hyperammina ramosa H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 33, pl. 3, figs. 14, 15; Denkschr. Akad. Wiss. Wien, vol. 42, 1881, p. 98; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 261, pl. 23, figs. 15–19.—H. B. Brady, Parker, and Jones, Trans. Zool. Soc. London, vol. 12, No. 7, 1888, p. 217, pl. 41, figs. 1–4, 13.—Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 255, pl. 4, fig. 15.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 18, pl. 4, figs. 61, 62.—Chapman, Proc. Zool. Soc., London, 1895, p. 13.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 22.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 270, pl. 11, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 260, figs. 101*a*, *b* (in text).—Chapman, Biol. Results Fishing Experiments *Endeavour* 1909–14, vol. 3, pt. 1, 1915, p. 13.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 220.

Saccorhiza ramosa Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 670.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 65, fig. 81 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1004.

Description.—Test free, consisting of an ovoid proloculum passing into a short tubular chamber, soon becoming branched, of nearly uniform diameter throughout; wall composed of sand grains, firmly cemented with numerous sponge spicules fixed in the outer layer, giving a bristling appearance to the whole test; apertures formed by the open ends of the tubular chamber; color reddish or yellowish brown or gray.

Distribution.—This is another of the very widely distributed species of colder waters although it is not by any means limited to cold-water areas as are certain other species. It is known from all the great

ocean basins and from the Antarctic to Franz Joseph Land. Its distribution is so wide that it is not necessary to quote separate regions. On the western side of the Atlantic it is already recorded by Goës and by Flint from the region of Cape Hatteras southward and at numerous stations in the Gulf of Mexico, and by Brady, Parker, and Jones from the Abrohlos Bank off Brazil.

In the *Albatross* material I have examined, it has occurred at nearly 50 stations, most of these being in the region between Georges Banks and Cape Hatteras, with some stations in the Gulf of Mexico, Caribbean Sea, and off the coast of Brazil. Depths at these stations range from 196 to 2,045 fathoms.

The selective habit of including sponge spicules in the outer layers of the wall seems to be very characteristic regardless of the bottom conditions.

Saccorhiza ramosa—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9886	U.S.N.M.	1	D2018....	37 12 22 N.; 74 20 04 W.	788	39	bu. m.....	Rare.
9861	U.S.N.M.	3	D2035....	39 26 16 N.; 70 02 37 W.	1,362	.....	glob. oz.....	Few.
9862	U.S.N.M.	5	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Few.
9863	U.S.N.M.	2	D2038....	38 30 30 N.; 69 08 35 W.	2,033	.....	glob. oz.....	Few.
9864	U.S.N.M.	7	D2041....	39 22 50 N.; 68 25 00 W.	1,608	38	glob. oz.....	Few.
9865	U.S.N.M.	4	D2042....	39 33 00 N.; 68 26 45 W.	1,555	38.5	glob. oz.....	Few.
9866	U.S.N.M.	8	D2043....	39 49 00 N.; 68 28 30 W.	1,467	38.5	glob. oz.....	Common.
9867	U.S.N.M.	1	D2048....	40 02 00 N.; 68 50 30 W.	547	39	ers. m. g....	Rare.
9868	U.S.N.M.	1	D2052....	39 40 05 N.; 69 21 25 W.	1,098	45	glob. oz.....	Rare.
9869	U.S.N.M.	2	D2072....	41 53 00 N.; 65 35 00 W.	858	39	gy. m.....	Rare.
9870	U.S.N.M.	3	D2097....	37 56 20 N.; 70 57 30 W.	1,917	.....	glob. oz.....	Few.
9871	U.S.N.M.	2	D2105....	37 50 00 N.; 73 03 50 W.	1,395	41	glob. oz.....	Few.
9872	U.S.N.M.	1	D2106....	37 41 20 N.; 73 03 20 W.	1,497	42.5	glob. oz.....	Rare.
9873	U.S.N.M.	3	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s.....	Few.
9874	U.S.N.M.	2	D2150....	13 34 45 N.; 81 21 10 W.	382	45.75	wh. ers. s....	Few.
9875	U.S.N.M.	3	D2174....	38 15 00 N.; 72 03 00 W.	1,594	.....	gy. m.....	Few.
9876	U.S.N.M.	1	D2189....	39 49 30 N.; 70 26 00 W.	600	39.7	gn. m. s.....	Rare.
9877	U.S.N.M.	10+	D2202....	39 38 00 N.; 71 39 45 W.	515	39.1	gn. m.....	Common.
9879	U.S.N.M.	4	D2204....	39 30 30 N.; 71 44 30 W.	728	39.1	br. m.....	Few.
9491	U.S.N.M.	2	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Few.
9492	U.S.N.M.	2	D2222....	39 03 15 N.; 70 50 45 W.	1,537	36.9	gy. oz.....	Few.
9493	U.S.N.M.	4	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Few.
9494	U.S.N.M.	1	D2231....	38 29 00 N.; 73 09 09 W.	965	36.8	gy. oz.....	Rare.
9495	U.S.N.M.	2	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Rare.
9880	U.S.N.M.	2	D2377....	27 07 30 N.; 88 08 00 W.	210	67	gy. m.....	Rare.
9881	U.S.N.M.	1	D2381....	28 05 00 N.; 87 56 15 W.	1,330	.....	lt. br. m.....	Rare.
9882	U.S.N.M.	10+	D2383....	28 32 00 N.; 88 06 00 W.	1,181	39.8	br. gn. m....	Common.
9883	U.S.N.M.	9	D2385....	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Common.
9496	U.S.N.M.	1	D2399....	28 44 00 N.; 86 18 00 W.	196	51.6	gy. m.....	Rare.
9498	U.S.N.M.	1	D2547....	39 54 30 N.; 70 20 00 W.	390	39.6	gn. m.....	Rare.
9499	U.S.N.M.	2	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Rare.
9500	U.S.N.M.	1	D2552....	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.....	Rare.
9501	U.S.N.M.	1	D2564....	39 22 00 N.; 71 23 30 W.	1,390	37.3	gy. oz.....	Rare.
9502	U.S.N.M.	3	D2570....	39 54 00 N.; 67 05 30 W.	1,813	36.8	glob. oz.....	Few.
9503	U.S.N.M.	2	D2581....	39 43 00 N.; 71 34 00 W.	394	.....	gn. m.....	Few.
9884	U.S.N.M.	2	D2677....	32 39 00 N.; 76 50 30 W.	478	39.3	gn. m.....	Few.
9504	U.S.N.M.	1	D2689....	39 42 00 N.; 71 15 30 W.	525	.....	gn. m.....	Rare.
9505	U.S.N.M.	1	D2713....	38 20 00 N.; 70 08 30 W.	1,859	.....	br. oz.....	Rare.
9506	U.S.N.M.	5	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Few.
9507	U.S.N.M.	2	D2731....	36 45 00 N.; 74 28 00 W.	781	.....	gy. oz.....	Few.
9508	U.S.N.M.	1	D2751....	16 54 00 N.; 63 12 00 W.	687	40	bu. glob. oz.	Rare.
9885	U.S.N.M.	1	D2760....	12 07 00 S.; 39 17 00 W.	1,019	39.5	br. co.....	Rare.
9509	U.S.N.M.	5	H58.....	17 48 20 N., 65 35 55 W.	1,345	.....	oz. for.....	Few.
9510	U.S.N.M.	5	H60.....	17 39 00 N.; 65 41 00 W.	578	.....	co. s. for....	Few.
9511	U.S.N.M.	3	H82.....	13 29 00 N.; 62 42 40 W.	1,051	.....	for.m.bk. sp.	Rare.
9512	U.S.N.M.	5	H86.....	12 58 40 N.; 62 48 00 W.	1,635	.....	bu. m. for. bk. sp.	Rare.

Genus SYRINGAMMINA H. B. Brady, 1883.

Syringammina H. B. Brady (type, *S. fragillissima* H. B. Brady), Proc. Roy. Soc. London, vol. 35, 1883, p. 155; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 242.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 224.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 997.

Description.—Test free or adherent, consisting of a bulbous base and many branching arms or of masses of anastomosing tubes in a rounded mass, wall of fine arenaceous particles with a small amount of inorganic cement; apertures at the extremities of the tubular portions.

Two species are known, *S. fragillissima*, dredged by the *Triton* in the Faroe Channel, and *S. minuta* Pearcey, from the Antarctic and probably off the Azores.

SYRINGAMMINA FRAGILLISSIMA H. B. Brady.

Plate 31, figs. 1, 2.

Syringammina fragillissima H. B. Brady, Proc. Roy. Soc. London, vol. 35, 1883, p. 155, pls. 2, 3; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 242, figs. 9*a–c* (in text).—Rhumbler, Arch. Prot., vol. 3, 1903, p. 224, fig. 47 (in text.)

According to Brady this form is as follows:

Test free, consisting of a rounded mass of branching, inosculating tubes, radiating from a common centre, and arranged in more or less distinct concentric tiers or layers which are marked by the formation at intervals of a network of lateral branches. Walls arenaceous, composed of nearly uniform fine sand, with little or no inorganic cement. Apertures terminal, situated at the peripheral ends of the tubes, closed in with loosely aggregated sand grains. Colour dark gray when wet, drying to a much lighter tint.

Diameter, about 1½ inches (38 mm.).

Distribution.—All that is known of this species are the two specimens dredged by the *Triton* in the Faroe Channel. A very full discussion of these specimens will be found in the *Challenger* Report (vol. 9, 1884, p. 243). The figures and description are from Brady.

Genus JACULELLA H. B. Brady, 1879.

Jaculella H. B. Brady (type, *J. acuta* H. B. Brady), Quart. Journ. Micr. Sci., vol. 19, 1879, p. 35.—Bütschli, in Bronn, Klassen und Ordnungen des Thierreichs, vol. 1, 1880, p. 193.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 255.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 273.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 70.

Description.—Test free, elongate, conical, widest at the apertural end, opposite end typically closed; wall comparatively thick, composed of sand grains firmly cemented, rough on the exterior; aperture formed by the open end of the tube, circular.

Although the tube is closed in complete specimens the distinction between proloculum and second chamber is slight, more definitely

shown in some specimens of *J. obtusa* which with their more bulbous basal end may represent the megalospheric form of the species.

From the obtainable data neither of the two species occurs in great numbers, scattered specimens being the rule.

JACULELLA ACUTA H. B. Brady.

Plate 32, figs. 1–4.

Jaculella acuta H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 35, pl. 3, figs. 12, 13.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 19, No. 4, 1882, p. 143, pl. 12, fig. 432.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 255, pl. 22, figs. 14–18.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 23.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 269, pl. 9, fig. 4.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 273, fig. 122 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 70, figs. 90, 91 (in text).—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 609, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 219.

Description.—Test elongate, straight, tapering, tubular, proximal end closed and acutely pointed, distal end broader, slightly constricted to form the aperture which is circular, wall thick, composed of coarse sand grains, firmly cemented, exterior rough, proximal end of the test often reddish brown, distal portion grayish.

Length variable, up to 25 mm. or even more.

Distribution.—The only North Atlantic stations recorded for this species are off the coasts of Norway and the British Isles and a single station and a single specimen in the Gulf of Mexico recorded by Göes. From the South Atlantic the *Challenger* dredged material from south of Pernambuco, Brazil, 350 fathoms, and off Buenos Aires, 1,900 fathoms.

From the *Albatross* material I have had typical material only from scattered stations all grouped in the region from Georges Banks to the latitude of the Delaware Capes. Specimens occur only in small numbers. Depths range from 852 to 2,045 fathoms, bottom temperatures from 34.4° to 41° F.

Jaculella acuta—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9704	U.S.N.M.	1	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Rare.
9705	U.S.N.M.	2	D2038....	38 30 30 N.; 69 08 35 W.	2,033	.....	gl b. oz.....	Rare.
9706	U.S.N.M.	1	D2013....	39 49 00 N.; 68 28 30 W.	1,167	38.5	glob. oz.....	Rare.
9707	U.S.N.M.	1	D2097....	37 56 20 N.; 70 57 30 W.	1,917	.....	glob. oz.....	Rare.
9708	U.S.N.M.	3	D2105....	37 50 00 N.; 73 03 50 W.	1,395	41	gl b. oz.....	Rare.
9354	U.S.N.M.	1	D2226....	37 00 00 N.; 71 54 00 W.	2,045	36.8	glob. oz.....	Rare.
9355	U.S.N.M.	3	D2229....	37 38 40 N.; 73 41 30 W.	1,423	37.7	gl b. oz.....	Rare.
9356	U.S.N.M.	1	D2530....	40 53 30 N.; 66 24 00 W.	956	28.4	gy. oz.....	Rare.
9357	U.S.N.M.	1	D2531....	40 42 00 N.; 66 33 00 W.	852	34.4	gy. m.....	Rare.
9358	U.S.N.M.	1	D2713....	38 20 00 N.; 70 08 30 W.	1,859	.....	br. oz.....	Rare.

JACULELLA OBTUSA H. B. Brady.

Plate 32, fig. 5.

Jaculella obtusa H. B. Brady, Proc. Roy. Soc. Edinburgh, vol. 11, 1882, p. 714; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 256, pl. 22, figs. 19–22.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 20, pl. 4, figs. 87–89; pl. 5, figs. 90, 91; Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 23.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 273, fig. 123 (in text).—F. Chapman, Journ. Linn. Soc. Zool., vol. 30, 1907, p. 24, pl. 3, fig. 49.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 71, fig. 92 (in text).—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, No. 3, 1911, p. 14, pl., fig. 5.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 41; Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 220.

Description.—Test elongate, straight, tubular, slightly if at all tapering, proximal end closed, obtusely rounded, distal end but slightly broader, its open end forming the aperture; wall thick composed of firmly cemented sand grains, exterior rough; color gray.

Length, 10–15 mm.

Distribution.—From the European side of the Atlantic the species is known from Bergen, Norway; Skagerack (Goës); Faroe Channel (H. B. Brady); several stations west of Scotland; and from the Clare Island region west of Ireland (Heron-Allen and Earland). Awerinzew records it from the Siberian Arctic. It is unrecorded from the western Atlantic. In the *Albatross* and other material I have examined it has occurred at but seven stations just south of 40° N. and around 70° W., with one farther north. Depths range from 1,362 to 1,917 fathoms and bottom temperatures from 36.9° to 41° F. From the northernmost station the depth is but 206 fathoms. From its general distribution it would seem that this species is more characteristic of cooler waters than is its closely related species, *J. acuta*.

Jaculella obtusa—material examined.

Cat. No.	Coll. of—	No. of speci-mens.	Station.	Locality.	Depth in fath-oms.	Bot-tom tem-pera-ture.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9709	U.S.N.M.	2	D2025....	39 26 16 N.; 70 02 37 W.	1,362	.....	Glob. oz	Rare.
9710	U.S.N.M.	2	D2097....	37 56 20 N.; 70 57 30 W.	1,917	.....	Glob. oz	Rare.
9711	U.S.N.M.	1	D2105....	37 50 00 N.; 73 03 50 W.	1,395	41	Glob. oz	Rare.
9359	U.S.N.M.	1	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	Gy. oz	Rare.
9360	U.S.N.M.	1	D2222....	39 03 15 N.; 70 50 45 W.	1,537	36.9	Gy. oz	Rare.
9361	U.S.N.M.	1	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	Br. m.....	Rare.
9362	U.S.N.M.	1	D2697....	47 40 00 N.; 47 35 30 W.	206	.....	Gn.m.bk.sp.	Rare.

Genus DENDROPHRYA Str. Wright, 1861.

Dendrophrya Str. Wright (type, *Dendrophrya erecta* Str. Wright), Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 133.—Bütschli, in Bronn, Klassen und Ordnungen Thierreichs, vol. 1, 1880, p. 195.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 237.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 220.

Description.—Test attached, consisting of a single chamber, erect or with spreading arms, tubular, irregular or branching, wall arenaceous, with a chitinous base; apertures at the ends of the arms. But a few species are known and these are largely confined to cold waters at comparatively shallow depths.

DENDROPHRYA ERECTA Str. Wright.

Plate 33, figs. 3, 4.

Dendrophrya erecta Str. Wright, Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 122, pl. 4, figs. 4–5.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 239, pl. 27A, figs. 7–9.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 221, fig. 45 (in text).

The original description is as follows:

Test consisting of an attached chamber, with one or more erect branching arms. Basal chamber patelloid or spreading, buried in sand or mud; arms rising either from the margin or from the convex surface, taking the form of irregularly branched chitinous tubes, more or less thickly coated with mud, with pseudopodial apertures at the distal extremities of the branchlets. Height, one-seventh inch (3.5 mm.).

Distribution.—Almost the only records for this and its related species are about the British Isles. The records are Old Granton Quarries, near Edinburgh (Str. Wright); low-tide pools, Cumbrae, Firth of Clyde (Robertson).

In the *Challenger* report Brady gives a very full account of this species. The figures and description are from Brady.

DENDROPHRYA RADIATA Str. Wright.

Plate 31, fig. 3; plate 32, figs. 6, 7.

Dendrophrya radiata Str. Wright, Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 122.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 238, pl. 27A, figs. 10–12.—Moebius, Abh. k. pr. Akad. Wiss. Berlin, 1888 (1889), p. 13, pl. 2, figs. 22–27.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 221, fig. 44 (in text).

Brady describes this species as follows:

Test sessile, depressed; consisting of a central chamber, with spreading, more or less adherent, tubular arms; arms very irregular in contour, often branching, the open distal extremities forming the pseudopodial apertures of the test. Walls chitinous, somewhat thickly coated with mud; central chamber in adult specimens firm and hard. Size very variable, rarely one-fourth inch (6 mm.) in diameter.

Distribution.—The following records are given for this species: Old Granton Quarries, near Edinburgh (Str. Wright); low-tide pools, Cumbrae, Firth of Clyde (Robertson); "quite common along the North Wales coast" (Siddall); Kiel Bay (Rhumbler).

Genus HALIPHYSEMA Bowerbank, 1862.

Haliphysema Bowerbank, Philos. Trans., 1862, p. 1105 (type, *H. tumanowiczii* Bowerbank).—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 280.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 266.

Squamulina (part) Carter, Ann. Mag. Nat. Hist., ser. 4, vol. 6, 1870, p. 346.

Description.—Test attached, with an expanded basal portion, and a columnar erect portion either simple or branched, wall arenaceous, usually with numerous included sponge spicules especially near the tips of the arms or the apertural end of the single chambered species; aperture at the free end of the chamber or at the ends of the branches, partially obscured by the irregular clustering of spicules.

There are several species with very distinct characters.

HALIPHYSEMA TUMANOWICZII Bowerbank.

Plate 33, figs. 1, 2.

Haliphysema tumanowiczii Bowerbank, Philos. Trans., 1862, p. 1105, pl. 73, fig. 3; Monogr. British Sponges, vol. 1, 1864, pl. 30, fig. 359; vol. 2, 1866, p. 76.—E. O. Schmidt, Spongien Adriat. Meeres, Suppl. II, 1866, p. 13, fig. 13.—Haeckel, Jena Zeitschr., vol. 11, 1877, p. 192.—Norman, Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 274.—Kent, Ann. Mag. Nat. Hist., ser. 5, vol. 2, 1878, p. 68, pls. 4, 5.—Lankester, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 476, pl. 22, figs. 1–11.—Norman, in Bowerbank, British Sponges, vol. 4, 1882, p. 33.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 281, pl. 27A, figs. 4, 5.—Duerden, Irish Nat., vol. 3, No. 11, 1894, p. 231.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 267, fig. 112 (in text).—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 42; Trans. Zool. Soc., vol. 20, 1915, p. 611; Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 222; Journ. Roy. Micr. Soc., 1916, p. 40.

Squamulina scopula Carter, Ann. Mag. Nat. Hist., ser. 4, vol. 5, 1870, p. 310, pl. 4; vol. 20, 1877, p. 337; ser. 5, vol. 1, 1878, p. 172; vol. 3, 1879, p. 407.—Kent, Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 1.

The original description was as follows:

Test consisting of an unbranched tubular column springing from an adherent disk. Disk convex, spuriously segmented; column straight or variously contorted, narrow at the base, and gradually increasing in diameter toward the distal end, which is either broad and rounded, or takes the form of an inflated or bulbous capitulum. Walls thin, arenaceous, more or less beset with sponge spicules, especially at the distal end.

Length, about one-twentieth of an inch (1.3 mm.).

Distribution.—Shallow water along coasts seems to be the ideal habitat for this species, 25 fathoms seeming to be the deepest record. There are many records of its occurrence about the British Isles and also off Bergen, Norway. Moebius records it from Mauritius and Heron-Allen and Earland from the Kerimba Archipelago off southeastern Africa. There are no records for the western Atlantic. Heron-Allen and Earland make the following remark, which probably accounts for its not being oftener recorded: "The species is probably of world-wide distribution, though the records are scanty, owing to its parasitic habit of growth and extreme friability."

In the material from *Albatross* station D2150, in 382 fathoms, in the Caribbean Sea (13° 34′ 45″ N.; 81° 21′ 10″ W.) (United States National Museum No. 9682), there is a single specimen rather low but with a cylindrical shape, broad base, and the upper portion

with the usual crown of spicules seen in this species. The material is white and the whole corresponds very closely with the description of Heron-Allen and Earland of the specimens from the Kerimba Archipelago and with the material obtained by Moebius from Mauritius. The depth of the Atlantic station is deep compared with other records.

HALIPHYSEMA RAMULOSUM Bowerbank.

Plate 34, fig. 1.

Haliphysema ramulosa Bowerbank, Monogr. British Sponges, vol. 2, 1866, p. 79; vol. 3, 1874, p. 33, pl. 13, fig. 1.—Carter, Ann. Mag. Nat. Hist., ser. 4, vol. 5, 1870, p. 389.—Haeckel, Jena Zeitschr., vol. 11, 1877, p. 193.—Norman, Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 275; in Bowerbank's Monogr. British Sponges, vol. 4, 1882, p. 38.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 283, pl. 27A, fig. 6.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 268, fig. 114 (in text).—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 41; Journ. Roy. Micr. Soc., 1916, p. 40.

Squamulina scopula "branched variety," Carter, Ann. Mag. Nat. Hist., ser. 4, vol. 6, 1870, p. 345.

Haliphysema capitulatum Moebius, Beil. Tag. 49 Vers. deutsch. naturf. Hamburg, 1876, p. 115.

Haliphysema tumanowiczii Moebius, Beitr. Meeresfauna Insel Mauritius, 1880, p. 72, pl. 1, figs. 1–5; pl. 2, fig. 1.

This form was originally described as follows:

Test consisting of one or more branching tubular columns springing from an adherent base. Basal portion convex, spreading, or tubular; column straight or irregularly bent, of nearly uniform diameter; branches ascending, somewhat thinner than the column, the distal extremity of each swollen or subglobular. Walls thin, arenaceous, beset with sponge spicules, especially near the distal extremities.

Height, from the base to the summit of the branches, one-tenth to one-fourth inch (2.5 to 6 mm.).

Distribution.—About the British Isles this species seems to occur in various localities as follows Budleigh-Salterton, Devon, between tide marks (Carter); Roundstone Bay, Ireland, on seaweed in shallow water; Guernsey, 15 fathoms (Norman); Cumbrae, low water, rare (Robertson); Clare Island region, Ireland, on Zoophytes and on roots of Laminaria and South Cornwall on Laminaria roots (Heron-Allen and Earland). Schmidt recorded it from material dredged by Pourtales off the coast of Florida. Rhumbler records it from the Kiel Canal and Moebius from Mauritius.

The remarks under the preceding species apply equally well to this.

Subfamily 4. Ammodiscinae.

Test composed of a globular proloculum and long, undivided tube, closely coiled, either planospirally or in changing planes or to form a spiral test; wall of fine sand with much cement, usually of a reddish or yellowish brown.

Ammodiscus and its allies *Glomospira*, *Ammodiscoides*, and *Turritellella* form a rather unified group in that they are all close coiled and are of fine material, with an abundance of reddish cement. All the tests seem to be free except in the genera *Ammolagena* and *Girvanella*. In some of the species both microspheric and megalospheric forms are known.

Genus AMMOLAGENA Eimer and Fickert, 1899.

Trochammina Jones and Parker (part) (type *Trochammina irregularis*, var. *clavata* Parker and Jones), Quart. Journ. Geol. Soc., vol. 16, 1860, p. 304.—W. B. Carpenter, Parker, and Jones, Introduction to the Study of the Foraminifera, 1862, p. 142.

Webbina H. B. Brady (part), Proc. Roy. Soc. Edinburgh, vol. 11, 1882, p. 711 (not *Webbina* d'Orbigny, 1839); Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 349.

Ammolagena Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 673.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 67.—Rhumbler, Foram. Plankton Exped., Teil 2, 1913, pp. 346, 371.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1003.

Webbinella Rhumbler (part), Arch. Prot., vol. 3, 1903, pp. 228, 229.

Description.—Test firmly attached, composed of an oval proloculum flattened on the under side and a second tubular chamber of variable length but of nearly uniform diameter, the open end serving as the aperture; wall finely arenaceous, the cement in excess of the sandy particles.

There seems to be no question of the correctness of the use of *Ammolagena* for this genus. Some authors still persist in the use of *Webbina* although its use for this species by Brady is not at all the sense in which d'Orbigny used the name.

AMMOLAGENA CLAVATA (Parker and Jones).

Plate 34, figs. 2–5; plate 35, figs. 1–3.

Trochammina irregularis, var. *clavata* Parker and Jones, Quart. Journ. Geol. Soc., vol. 16, 1860, p. 304.

Trochammina irregularis (part) W. B. Carpenter, Parker, and Jones, Introd. Foram., 1862, p. 142, pl. 11, fig. 6.

Webbina clavata H. B. Brady, Proc. Roy. Soc. Edinburgh, vol. 11, 1882, p. 711; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 349, pl. 41, figs. 12–16.—H. B. Brady, Parker, and Jones, Trans. Zool. Soc., vol. 12, pt. 7, 1888, p. 218, pl. 42, fig. 21.—J. Wright, Proc. Roy. Irish Acad., vol. 1, 1891, p. 470, pl. 20, figs. 2, 3.—Göes, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 32, pl. 6, figs. 245, 246.—Chapman, Proc. Zool. Soc. London, 1895, p. 18.—Göes, Bull. Mus. Comp, Zoöl., vol. 29, 1896, p. 35.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 279, pl. 24, fig. 3.—Kiaer, Norske Nordhavs Expedition, No. 25, 1899, p. 4.—Bagg, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 129.

Ammolagena clavata Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 673.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 68, figs. 86–89 (in text).—Rhumbler, Foram. Plankton Exped., Teil 1, 1911, pp. 93, 96, 197, pl. 1, figs. 1, 2; Teil. 2, 1913, p. 371.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1004.

Webbinella clavata Rhumbler, Arch. Prot., vol. 3, 1903, p. 229, fig. 55 (in text).

Description.—Test firmly attached, proloculum oval or pyriform, the basal portion flattened by the surface to which it is attached, second chamber elongate, tubular, free or attached, of nearly uniform diameter, when free circular in transverse section, wall thin, of fine sand grains with an excess of yellowish or reddish cement, smooth and polished; open end of the tube serving as the aperture.

Longer diameter of proloculum, 0.5–1.3 mm.

Distribution.—This is one of the most widely distributed species of the family. In general, however, it seems most abundant in warm waters, on the western side of the Atlantic being found in greater numbers in the Gulf of Mexico and the Caribbean Sea than along the coast from Florida to Cape Cod. Scattered stations carry the distribution up the coast to the banks off Cape Cod, but it has not been found in the material from farther north along this coast. Southward it occurs off Bahia, Brazil, and at scattered stations to the Falkland Islands. Specimens have occurred off Greenland, Faroe Channel, off Norway, off Ireland, and in the Mediterranean. Scattered stations in mid-Atlantic give a distribution of the species from the Azores to latitude 40° S.

Specimens attach themselves to various objects, in tropical waters especially to broken shell fragments, in shallow northern waters to pebbles and coarse sand grains, in deep water to the various otoliths that abound and to many other genera of Foraminifera.

Both microscopic and megalospheric specimens occur, the former having a comparatively smaller proloculum but much longer tubular chamber.

Rhumbler mentions that specimens at least occasionally build a definite floor to the proloculum and I have noted a similar condition. The floor over the attachment is, however, usually much thinner than that of the convex surface of the test but not invariably so. The wall of the proloculum usually has a slightly larger proportion of sand particles than the tubular second chamber but in either case the cement predominates. Occasionally there is a second tubular chamber as the opposite side from the usual one, and in one case I have noted there are two tubes apparently side by side from the same point of the proloculum.

Ammolagena clavata—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9560	U.S.N.M.	5	D2150	13 34 45 N.; 81 21 10 W.	382	45.75	wh. crs. s...	Common.
9561	U.S.N.M.	1	D2217	39 47 20 N.; 69 34 15 W.	924	38.1	gy. m.....	Rare.
9562	U.S.N.M.	3	D2383	28 32 00 N.; 88 06 00 W.	1,181	39.8	br. gn. m....	Few.
9563	U.S.N.M.	10+	D2385	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Few.
9564	U.S.N.M.	2	D2392	28 47 30 N.; 87 27 00 W.	724	40.7	br. gy. m....	Few.
9215	U.S.N.M.	1	D2399	28 44 00 N.; 86 18 00 W.	196	51.6	gy. m.....	Few.
9216	U.S.N.M.	1	D2581	39 43 00 N.; 71 34 00 W.	394	.....	gn. m.....	Rare.
9565	U.S.N.M.	2	D2677	32 39 00 N.; 76 50 30 W.	478	39.3	gn. m.....	Few.
9566	U.S.N.M.	8	D2678	32 40 00 N.; 76 40 30 W.	731	38.7	lt. gy. oz....	Few.
9567	U.S.N.M.	3	D2679	32 40 00 N.; 76 40 30 W.	782	38.6	lt. gy. oz....	Few.
9217	U.S.N.M.	1	D2751	16 54 00 N.; 63 12 00 W.	687	40	bu. glob. oz.	Few.
9568	U.S.N.M.	1	D2761	15 39 00 S.; 38 32 54 W.	818	39	pter. oz.....	Rare.
9218	U.S.N.M.	1	H56	17 44 15 N.; 65 27 50 W.	1,243	.....	pter. co. oz. for.	Rare.
9219	U.S.N.M.	1	H82	13 29 00 N.; 62 42 40 W.	1,051	.....	for. m. bk. sp.	Rare.
9220	U.S.N.M.	1	H86	12 58 40 N.; 62 48 00 W.	1,635	.....	bu. m. for. bk. sp.	Rare.

Genus GIRVANELLA Nicholson and Etheridge, 1878.

Girvanella Nicholson and Etheridge (*Hyperammina vagans* (H. B. Brady)) Monogr. Silur. Foss. Gervais, vol. 1 (1880), 1878, p. 23.—Rhumbler, Foram. Plankton Exped., pt. 2, 1913, pp. 386, 419.

Hyperammina H. B. Brady (part), Quart. Journ. Micr. Sci., vol. 19, 1879, p. 33; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 260.

Tolypammina Rhumbler, Nachr. Köngl. Ges. Wiss. Göttingen, 1895, p. 83; Arch. Prot., vol. 3, 1903, p. 276.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 66.

Serpulella Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 674.

Description.—Test typically adherent by its undersurface, but may become free; consisting of an elongate oval proloculum and a long irregular second chamber, tubular, with nearly even diameter unbranched; composed of sand grains and a large proportion of yellowish or reddish brown cement.

The three species here considered seem to belong to this genus proposed in 1878 by Nicholson and Etheridge for fossil species. From the general characters of the test it is placed under the subfamily Ammodiscinae.

GIRVANELLA VAGANS (H. B. Brady).

Plate 35, figs. 4, 5; plate 36, fig. 1.

Hyperammina vagans H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 33, pl. 3, fig. 5; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 260, pl. 24, figs. 1–9.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 270, pl. 11, fig. 2.—Chapman and Howchin, Mem. Geol. Surv. N. S. Wales, vol. 14, 1905, p. 6, pl. 2, fig. 1.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 41, pl. 2, fig. 9; Trans. Zool. Soc. London, vol. 20, 1915, p. 610; Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 221; Journ. Roy. Micr. Soc., 1916, p. 40.

Tolypammina vagans Rhumbler, Nachr. Köngl. Ges. Wiss. Göttingen, 1895, p. 83; Zeitschr. Allg. Phys., vol. 2, 1902, p. 281, fig. 97; Arch. Prot., vol. 3, 1903, p. 277, figs. 125*a*, *b* (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 67, figs. 84, 85 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1004.

Serpulella vagans Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 674.

Girvanella vagans Rhumbler, Foram. Plankton Exped., pt. 1, 1911, pl. 4, figs. 1, 2; pt. 2, 1913, p. 419.

Description.—Test adherent, consisting of an oval-elongate proloculum and a long irregularly winding tube of nearly uniform diameter, unbranched; wall composed of sand grains of small size with an abundance of reddish-brown cement; surface smooth, both without and within, aperture formed by the open end of the tubular chamber; color reddish brown, except the growing tip, which is occasionally lighter, the proloculum often darker than the second chamber.

Diameter of tube, 0.05 to 0.2 mm.; length, 1 mm. or much more if the coils were straightened out.

Distribution.—From all the records obtainable this is a very widely distributed species, in the colder Arctic waters occurring in a few fathoms (Brady) to 3,800 fathoms in the *Challenger* North Pacific material. It is known from the Arctic, from the North Sea and about the British Isles, and from deep water of the Atlantic, on the western side recorded by Flint from the Gulf of Mexico. It is known from the Pacific (Brady, Cushman) and from the Antarctic (Pearcey).

In the *Albatross* material I have examined, it has occurred at 36 stations from the latitude of Georges Banks southward along the coast, in the Gulf of Mexico, the Caribbean Sea, north of Panama and just westward of the Lesser Antilles, and off the coast of Brazil. These stations range in depth from 159 to 1,769 fathoms, bottom temperatures from 36.9° to 51.6° F., the highest in the Gulf of Mexico, in depths less than 200 fathoms

There has been much shifting of this species, but it now seems that Rhumbler is correct in assigning it to *Girvanella*, a genus described in 1878 by Nicholson and Etheridge for fossil specimens before *Hyperammina* was described by Brady in 1879. As this species had already been distinguished from *Hyperammina* by later authors it need not affect the standing of the other species still placed under that genus, unless by those authors who still persist in placing *G. vagans* under *Hyperammina*. In such a case they are compelled by rules of nomenclature to use *Girvanella* for the whole genus, unless they reject the affinity of the fossil material.

From the closeness of this genus in the construction of the wall and its general characters, especially those of *G. schaudinii* and *G. frigida*, where the coiling is more regular, it seems advisable to follow Rhumbler and place these species under the subfamily Ammodiscinae, treating *Girvanella* as an uncoiled or irregular form with affinities with *Ammodiscus* and related genera.

Girvanella vagans—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9645	U.S.N.M.	1	D2035....	39 26 16 N.; 70 02 37 W.	1,362	.....	glob. oz.....	Rare.
9646	U.S.N.M.	1	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Rare.
9647	U.S.N.M.	8	D2041....	39 22 50 N.; 68 25 00 W.	1,608	38	glob. oz.....	Common.
9648	U.S.N.M.	2	D2043....	39 49 00 N.; 68 23 30 W.	1,467	38.5	glob. oz.....	Few.
9649	U.S.N.M.	3	D2052....	39 40 05 N.; 69 21 25 W.	1,098	45	glob. oz.....	Few.
9650	U.S.N.M.	2	D2072....	41 53 00 N.; 65 35 00 W.	858	39	gy. m.....	Few.
9919	U.S.N.M.	10+	D2095....	39 29 00 N.; 70 58 40 W.	1,342	.....	glob. oz.....	Few.
9651	U.S.N.M.	2	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fno. s....	Few.
9652	U.S.N.M.	2	D2150....	13 34 45 N.; 81 21 10 W.	382	45.75	wh. ers. s...	Few.
9653	U.S.N.M.	5	D2174....	38 15 00 N.; 72 03 00 W.	1,594	.....	gy. m.....	Few.
9654	U.S.N.M.	1	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Rare.
9655	U.S.N.M.	1	D2208....	39 33 00 N.; 71 16 15 W.	1,178	38.4	gn. m.....	Rare.
9293	U.S.N.M.	4	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Few.
9294	U.S.N.M.	2	D2229....	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Few.
9295	U.S.N.M.	4	D2231....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Few.
9296	U.S.N.M.	2	D2314....	32 43 00 N.; 77 51 00 W.	159	47.4	crs.s. bk.sp. brk. sh.	Few.
9656	U.S.N.M.	1	D2381....	28 05 00 N.; 87 56 51 W.	1,330	.....	lt. br. m.....	Rare.
9657	U.S.N.M.	1	D2385....	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Rare.
9658	U.S.N.M.	1	D2392....	28 47 30 N.; 87 27 00 W.	724	40.7	br. gy. m....	Rare.
9659	U.S.N.M.	1	D2399....	28 44 00 N.; 86 18 00 W.	196	51.6	gy. m.....	Few.
9297	U.S.N.M.	4						
9298	U.S.N.M.	3	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Few.
9299	U.S.N.M.	1	D2562....	39 15 30 N.; 71 25 00 W.	1,434	37.3	gy. oz.....	Rare.
9300	U.S.N.M.	2	D2564....	39 22 09 N.; 71 33 30 W.	1,390	37.3	gy. oz.....	Few.
9301	U.S.N.M.	1	D2572....	40 29 00 N.; 66 04 00 W.	1,769	37.8	gy. oz.....	Rare.
9924	U.S.N.M.	2	D2651....	24 02 00 N.; 77 12 45 W.	97	73.4	wh. oz.....	Rare.
9660	U.S.N.M.	3	D2678....	32 40 00 N.; 76 40 30 W.	731	38.7	lt. gy. oz....	Few.
9302	U.S.N.M.	2	D2682....	39 38 00 N.; 70 22 00 W.	1,004	.....	gn. m. s.....	Few.
9303	U.S.N.M.	1	D2714....	38 22 00 N.; 70 17 30 W.	1,825	.....	br. oz.....	Rare.
9304	U.S.N.M.	10+	D2716....	38 29 30 N.; 70 57 00 W.	1,631	.....	br. oz. for...	Common.
9305	U.S.N.M.	2	D2751....	16 54 00 N.; 63 12 00 W.	687	40	bu. glob. oz.	Few.
9661	U.S.N.M.	1	D2760....	12 07 00 S.; 37 17 00 W.	1,019	39.5	br. co.....	Few.
9306	U.S.N.M.	1	H56.....	17 44 15 N.; 65 27 50 W.	1,243	.....	pter. co. oz. for.	Few.
9351	U.S.N.M.	2	H58.....	17 48 20 N.; 65 35 35 W.	1,315	.....	co. s. for.....	Few.
9302	U.S.N.M.	1	H60.....	17 39 00 N.; 65 44 00 W.	578	.....	co. s. for.....	Rare.
9307	U.S.N.M.	1	H79.....	14 20 30 N.; 63 10 00 W.	821	.....	co. s. sh. for.	Rare.
9308	U.S.N.M.	1	H88.....	12 29 00 N.; 62 38 39 W.	1,630	.....	m. bk. sp. for	Rare.

GIRVANELLA FRIGIDA, new species.

Description.—Test small, attached, early portion irregularly coiled, later portion irregularly placed; wall composed largely of reddish-brown cement with a comparatively small amount of fine arenaceous material; aperture at the open end of the tubular chamber; color reddish brown.

Diameter of entire test rarely over 0.5 mm.

Distribution.—Type-specimen (U.S.N.M. No. 9912) from Speedwell station 219 off Cape Ann in 32 fathoms. It was also obtained in the same region station 236 in 28 fathoms and 2 *Albatross* stations. It occurs on rock specimens from off Halifax Harbor and seems to be common on rocks on the New England coast in cold water.

This is much smaller than *G. vagans* and is usually somewhat roughly coiled at the beginning before it starts its irregular winding course over the rock to which it is attached. It appears to be characteristic of the surface of dredged rocks off the New England coast.

Girvanella frigida—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9913	U.S.N.M.	10+	D2456....	47 29 00 N.; 52 18 00 W.	86	.....	g.....	Common.
9921	U.S.N.M.	10+	D2466.... Speedwell	45 29 00 N.; 55 24 00 W.	67	30	cs.....	Common.
9912	.....	10+	219.....	42 30 00 N.; 70 33 00 W.	32	55.5	rky.....	Common.
9916	.....	10+	236.....	42 28 00 N.; 70 31 00 W.	28	48.5	rky. crs. s...	Common.

GIRVANELLA SCHAUDINNI (Rhumbler).

Plate 36, fig. 2.

?*Hyperammin vagans* H. B. Brady (part), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 260, pl. 24, figs. 7–9 (not figs. 1–6).

Tolypammina schaudinni Rhumbler, Arch. Prot., vol. 3, 1903, p. 277, fig. 126.

Girvanella schaudinni Rhumbler, Foram. Plankton-Exped., pt. 1, 1911, pl. 4, figs. 3, 4; pt. 2, 1913, p. 420.

Description.—Test free at least in the adult, very irregularly coiled, wall with a chitinous inner layer, the main wall composed of sand grains with an abundance of yellowish or reddish brown cement; aperture formed by the open end of the second or tubular chamber.

Diameter, 0.1–0.3 mm. or more.

Distribution.—Type station for this species is from the Plankton-Expedition stations south of Boavista, Cape Verde Islands, 50–160 meters, and also recorded later by Rhumbler from off the Hebrides in 1,524 meters.

In the *Albatross* material I have had material seemingly referable to this species from three stations southwestward from Cape Cod, D2222, in 1,537 fathoms, bottom temperature 36.9° F.; D2229, in 1,423 fathoms, bottom temperature 37.7° F., and D2234, in 810 fathoms, bottom temperature 38.6° F.

This species tends to show a connection toward such species as *Turritellella spectabilis* in its irregularity of coiling and at the same time on the other hand is surely related to the more typical species of *Girvanella*.

Girvanella schaudinii—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9290	U.S.N.M.	2	D2222....	39 03 15 N.; 70 50 45 W.	1,537	36.9	gy. oz.....	Rare.
9291	U.S.N.M.	1	D2229....	37 38 40 N.; 73 16 30 W.	1,423	37.7	glob. oz.....	Rare.
9292	U.S.N.M.	3	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Rare.

Genus AMMODISCUS Reuss, 1861.

Operculina (part) d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, p. 49.

Orbis Strickland, Quart. Journ. Geol. Soc., vol. 2, 1848, p. 30 (not *Orbis* of Philippi-*Cornuspira*).

Spirillina Williamson, Rec. Foram. Great Britain, 1858, p. 93 (not *Spirillina* Ehrenberg, 1841).

Trochammina (part) Jones and Parker, Quart. Journ. Geol. Soc., vol. 16, 1860, p. 304.—W. B. Carpenter, Parker, and Jones, Introd. Foram., 1862, p. 141.

Ammodiscus (part) Reuss, Sitz. Akad. Wiss. Wien., vol. 44 (1), 1861 (1862), p. 365 (*Type*, *A. incertus* (d'Orbigny)).—Bütschli, in Bronn, Klassen und Ordnungen des Thierreichs, vol. 1, 1880, p. 189.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 329.—Rhumbler, Nachr. Ges. Wiss. Göttingen, 1895, p. 84.—Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 614.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 280.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 73.—Rhumbler, Foram. Plankton Exped., pt. 2, 1913, p. 387.

Cornuspira (part) Reuss and various authors (not *Cornuspira* Schultze).

Involutina (part) Terquem, Mém. Acad. Imp. Metz, 1860–61 (1862), p. 450; 1862–63 (1863), p. 221.

Description.—Test free, planospiral, composed of a globular proloculum and long, undivided tubular second chamber, coiled regularly in one plane; wall finely arenaceous, cement yellowish or reddish brown, surface smooth, aperture formed by the open end of the chamber.

As here used, *Ammodiscus* is restricted to include those species in which the test is typically planospiral throughout.

AMMODISCUS INCERTUS (d'Orbigny).

Plate 39.

Operculina incerta d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminiféres," p. 49, pl. 6, figs. 16, 17; Spanish Edit., 1840, p. 71, pl. 6, figs. 16, 17.

Spirillina arenacea Williamson, Rec. Foram. Great Britain, 1858, p. 93, pl. 7, fig. 203.

Trochammina squamata, var. *incerta* Jones and Parker, Quart. Journ. Geol. Soc., vol. 16, 1860, p. 304.—Parker and Jones, Appendix to W. B. Carpenter, Parker, and Jones, Intr. Foram., 1862, p. 312.

Trochammina incerta W. B. Carpenter, Parker, and Jones, Intr. Foram., 1862, p. 141, pl. 11, fig. 2.—Haeusler, Ann. Mag. Nat. Hist., ser. 5, vol. 10, 1882, p. 52, pl. 3.

Ammodiscus incertus H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 330, pl. 38, figs. 1–3.—Sherborn and Chapman, Journ. Roy Micr. Soc., 1889, p. 484, pl. 11, fig. 7.—Burrows, Sherborn, and Bailey, Journ. Roy. Micr. Soc., 1890, p. 552, pl. 8, fig. 8.—J. Wright, Proc. Roy. Irish Acad., vol. 1, 1891, p. 468.—Chapman, Journ. Roy. Micr. Soc., 1892, p. 326, pl. 6, fig. 11.—Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 263, pl. 5, figs.

35, 36.—Göes, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 31, pl. 6, figs. 238, 239.—Chapman, Proc. Zool. Soc. London, 1895, p. 17; Ann. Mag. Nat. Hist., ser. 6, vol. 16, 1895, p. 315, pl. 11, figs. 8, 9.—Göes, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 34 (part).—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 278, pl. 23, fig. 2.—Millett, Journ. Roy. Micr. Soc., 1899, p. 362.—Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 614, fig. 32 (in text).—Rhumbler, Zeitschr. Allg. Phys., vol. 2, 1902, p. 1, fig. 18; Arch. Proc., vol. 3, 1903, p. 280, fig. 129 (in text).—Sidebottom, Mem. and Proc. Manchester Lit. and Philos. Soc., vol. 49, No. 5, 1905, p. 5.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 73, figs. 85, 86 (in text).—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 49.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1005.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 225.

Ammodiscus tenuis H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 51; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 332, pl. 38, figs. 4-6.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 31, pl. 6, figs. 240, 241.—Chapman, Proc. Zool. Soc. London, 1895, p. 18.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 279, pl. 23, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 281, fig. 130 (in text).—Heron-Allen and Earland, Trans Zool. Soc., vol. 20, 1915, p. 618.

Description.—Test free, planospiral, composed of an ovoid proloculum followed by a long, spirally coiled, undivided second chamber in a single plane, in the microspheric form coils very small in the center and gradually increasing toward the periphery, in the megalospheric form coils much larger in the central portion and increasing but little toward the peripheral region; adult with the outer whorls about as wide as high in transverse section; wall finely arenaceous, usually with an excess of cement; color usually yellowish or reddish brown in fresh specimens or in alcoholic ones often with the area about the aperture whitish; aperture formed by the open end of the chamber.

Diameter of test, up to 6 mm.

Distribution.—This is a very widely distributed species. It has been found in all the great oceans except the Arctic, Pearcey recording it in his paper from the Antarctic. It is recorded from the Mediterranean. In the Atlantic it is now known from the coasts of France, Belgium, and the British Isles; from the North Sea; shores of Norway and Sweden. This side of the Atlantic it has occurred in material from Newfoundland southward, in the Gulf of Mexico and Caribbean Sea as well as off the eastern coast of South America near Bahia, Brazil.

Most of the Atlantic records are from water less than a thousand fathoms, the deepest 1,350 fathoms. Most of the *Albatross* material dredged off our coast is from between 500 and 1,000 fathoms in depth. Most of the bottom temperatures range between 38.6° and 40.6° F.

Both the microspheric and megalospheric forms are usually found at the same station. The latter is the *A. tenuis* of Brady. Usually in the Atlantic material, as elsewhere, the megalospheric form is

the more common but does not attain the size that the adult microspheric form does.

In connection with the bottom temperatures and distribution it seems that this species is more abundant under rather cold conditions. As a result it is not surprising to find that in the cold area along our eastern coast it is much more frequently met with than in material from farther south.

Ammodiscus incertus—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9544	U.S.N.M.	1	D2003....	37 16 30 N.; 74 20 36 W.	641	.....	.....	Rare.
9545	U.S.N.M.	2	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Few.
9546	U.S.N.M.	1	D2048....	40 02 00 N.; 68 50 30 W.	547	39	crs. m. g....	Rare.
9547	U.S.N.M.	3	D2115....	35 49 30 N.; 74 34 45 W.	843	39	m. fne. s.....	Few.
9548	U.S.N.M.	1	D2144....	9 49 00 N.; 79 31 30 W.	896	.....	gn. m.....	Rare.
9549	U.S.N.M.	2	D2171....	37 59 30 N.; 73 48 40 W.	444	39.5	gn. m.....	Rare.
9550	U.S.N.M.	2	D2202....	39 38 00 N.; 71 39 45 W.	515	39.1	gn. m.....	Few.
9551	U.S.N.M.	4	D2203....	39 34 15 N.; 71 41 15 W.	705	38.9	gn. m. s.....	Few.
9552	U.S.N.M.	1	D2213....	39 58 30 N.; 70 30 00 W.	384	39.5	gn. m.....	Rare.
9203	U.S.N.M.	1	D2214....	39 57 00 N.; 70 32 00 W.	475	39.5	gn. m.....	Few.
9204	U.S.N.M.	9	D2234....	39 09 00 N.; 72 03 15 W.	810	38.6	gn. m.....	Few.
9205	U.S.N.M.	2	D2237....	39 12 17 N.; 72 09 30 W.	520	39.5	gn. m.....	Rare.
9552	U.S.N.M.	8	D2242....	40 15 30 N.; 70 27 00 W.	58	51.4	gn. m.....	Few.
9554	U.S.N.M.	1	D2263....	37 08 00 N.; 74 33 00 W.	430	.....	gn. m.....	Rare.
9556	U.S.N.M.	5	D2385....	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Rare.
9206	U.S.N.M.	1	D2400....	28 41 00 N.; 86 07 00 W.	169	.....	gy. m.....	Rare.
9207	U.S.N.M.	4	D2504....	44 23 00 N.; 61 22 45 W.	82	40.6	bk. m. g.....	Rare.
9208	U.S.N.M.	10+	D2547....	39 51 30 N.; 70 20 00 W.	390	39.6	gy. oz.....	Abundant.
9209	U.S.N.M.	2	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Few.
9210	U.S.N.M.	1	D2552....	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.....	Rare.
9211	U.S.N.M.	1	D2581....	39 43 00 N.; 71 31 00 W.	394	.....	gn. m.....	Rare.
9557	U.S.N.M.	1	D2677....	32 39 00 N.; 76 50 30 W.	478	39.2	gn. m.....	Rare.
9558	U.S.N.M.	10	D2678....	32 40 00 N.; 76 40 30 W.	731	38.7	lt. gy. oz....	Few.
9559	U.S.N.M.	8	D2679....	32 40 00 N.; 76 40 30 W.	782	38.6	lt. gy. oz....	Few.
9212	U.S.N.M.	10+	D2680....	39 50 00 N.; 70 26 00 W.	555	.....	.....	Frequent.
9213	U.S.N.M.	1	D2729....	36 36 00 N.; 74 32 00 W.	679	.....	d k. gn. m....	Rare.
9214	U.S.N.M.	1	.....	Off Wiskon Rocks, off Key West, Fla.	144	.....	.....	Rare.

Genus AMMODISCOIDES Cushman, 1909.

Ammodiscoides Cushman, Pros. U. S. Nat. Mus., vol. 36, 1909, p. 424 (type. *Ammodiscoides turbinatus* Cushman).—Rhumbler, Foram. Plankton-Exped., pt. 2, 1913, p. 388.

Description.—Test free, spiral, initial chamber followed by a coiled nonseptate tube the microspheric form at least, with the early portion forming a hollow cone; later portions becoming broadly flaring usually slightly concave in the opposite direction from that of the early conical portion, wall finely arenaceous, smooth, aperture terminal.

This genus was split off from *Ammodiscus*, which is planospiral both in the early stages and the later whorls as well while *Ammodiscoides* has a definite conical young and broadly flaring later development.

In the material examined there are megalospheric specimens which occur with typical microspheric ones but which do not show as clearly the early conical condition. This is in conformity with so many genera that show the full characters only in the microspheric form and which in the megalospheric form do not show these as well,

The extension of range of this genus from its earliest discovery is noted under the distribution of the type species.

AMMODISCOIDES TURBINATUS Cushman.

Plate 36, figs. 3–6; plate 37.

Ammodiscoides turbinatus CUSHMAN, Proc. U. S. Nat. Mus., vol. 36, 1909, p. 424, pl. 33, figs. 1–6.—RHUMBLER, Foram. Plankton-Exped., pt. 2, 1913, p. 388, text figs. 124*a*, *d*.

Description.—Test in the microspheric form with a proloculum followed by a long, coiled, nonseptate chamber, in the young forming a hollow cone of about 10 coils. The whorls of nearly uniform diameter, later portion broadly flaring, concave, whorls increasing in diameter toward the periphery, peripheral edge somewhat flattened; wall of fine sand grains with a chitinous cement, surface smooth, of a dark reddish brown color; aperture low and broad, quadrangular, without a definite lip.

Maximum diameter of microspheric specimens, 3 mm.

Distribution.—The type station for this species is *Albatross* D2383. in the northern portion of the Gulf of Mexico, in 1,181 fathoms. The specimens from this station were found in material selected by Goës under the name *Ammodiscus incertus*. In a reexamination of the unsorted material from this station other specimens were found. Also it has been found in material from six other stations in the same general region; D2377, 210 fathoms, bottom, temperature 67° F.; D2384, 940 fathoms, bottom temperature 39.6° F.; D2385, 730 fathoms, bottom, temperature 40.1° F.; D2393, 525 fathoms, bottom temperature 41.1° F.; D2398, 227 fathoms, bottom temperature 48.6° F.; and D2399, 196 fathoms, bottom temperature 51.6° F. Widely separated from this general area specimens occurred at D2760, in 1,019 fathoms, bottom temperature 39.5° F., off the eastern coast of South America, near Bahia, Brazil.

The species seems to be limited to this distribution and southern in its tendencies. It has not been found in any of the abundant material off the eastern coast of North America from Florida to Newfoundland nor in the other portions of the Gulf of Mexico or the Caribbean Sea from which material has been examined.

It is also worthy of note that the species does not seem to occur usually with *Ammodiscus incertus*.

Ammodiscoides turbinatus—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9538	U.S.N.M.	9	D2377....	27 07·30 N.; 88 08 00 W.	210	67	gy. m.....	Few.
9539	U.S.N.M.	10+	D2383....	28 32 00 N.; 88 06 00 W.	1,181	39.8	br. gn. m....	Common.
9540	U.S.N.M.	1	D2384....	28 45 00 N.; 88 15 30 W.	940	39.6	br. gn. m....	Rare.
9541	U.S.N.M.	10+	D2385....	28 51 00 N.; 88 18 00 W.	730	40.1	gy. m.....	Common.
9202	U.S.N.M.	2	D2393....	28 43 00 N.; 87 14 30 W.	525	41.1	lt. gy. m....	Rare.
9542	U.S.N.M.	2	D2398....	28 45 00 N.; 86 26 00 W.	227	48.6	gy. m.....	Few.
9201	U.S.N.M.	2	D2399....	28 44 00 N.; 86 18 00 W.	196	51.6	gy. m.....	Few.
9543	U.S.N.M.	3	D2760....	12 07 00 S.; 37 17 00 W.	1,019	39.5	br. co.....	Few.

Genus GLOMOSPIRA Rzehak, 1888.

Trochammina (part) Jones and Parker, Quart. Journ. Geol. Soc., vol. 61, 1860, p. 304.

Ammodiscus (part) Siddall, Cat. Brit. Foram., 1879, p. 5.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol 9, 1884, p. 333.

Glomospira Rzehak, Verh. k. k. geol. Reichs., 1888, p. 191 (type, *Trochammina gordialis* Jones and Parker).—Schubert (part), Jahrb. k. k. geol. Reichs., vol. 58, 1908, p. 380.—Rhumbler, Plankton Exped., Foraminiferen, pt. 2, 1913, p. 387, 421.

Gordiammina Rhumbler, Nachr. Ges. Wiss. Göttingen, 1895, p. 84; Arch. Prot., vol. 3, 1903, p. 281.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 76.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1005.

Description.—Test composed of a subglobular proloculum and long, undivided second chamber, winding upon itself in various planes, not completely spiral throughout, wall finely arenaceous, with a predominance of cement, smooth both without and within, color reddish or yellowish brown.

From the original references, *Glomospira* Rzehak must be used for this genus instead of *Gordiammina* Rhumbler. There are two recent species.

GLOMOSPIRA GORDIALIS (Jones and Parker).

Plate 36, figs. 7–9.

Trochammina squamata, var. *gordialis* Jones and Parker, Quart. Journ. Geol. Soc., vol. 16, 1860, p. 304.—Parker and Jones, Philos. Trans., vol. 155, 1865, p. 408, pl. 15, fig. 32.

Trochammina gordialis W. B. Carpenter, Parker, and Jones, Intr. Foram., 1862, p. 141, pl. 11, fig. 4.—Jones, Parker, and Kirby, Ann. Mag. Nat., Hist., ser. 4, vol. 4, 1869, p. 390, pl. 13, figs. 7, 8.—Wright, Proc. Belfast Field Club, 1876-77 (App.), pl. 4, fig. 3.—Haeusler, Ann. Mag. Nat. Hist., ser. 5, vol. 10, 1882, p. 55, pls. 3 and 4, figs. 8–20.

Trochammina (*Ammodiscus*) *gordialis* Haeusler, Neues Jahrb., 1883, p. 59, pl. 4, figs. 2, 3.

Ammodiscus gordialis Siddall, Cat. Brit. Rec. For., 1879, p. 5.—Bütschli, in Bronn's Klassen und Ordnungen des Thierreichs, vol. 1, 1880, p. 196, pl. 5, fig. 22.—H. B. Brady, Denkschr. Akad. Wiss. Wien, vol. 42, 1881, p. 100; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 333, pl. 38, figs. 7–9.—Haeusler,

Neues Jahrb., Beil., vol. 4, 1885, p. 24, pl. 3, figs. 10–22, 31.—H. B. Brady, Parker, and Jones, Trans. Zool. Soc., vol. 12, 1888, p. 218, pl. 42, fig. 22.—J. Wright, Proc. Roy. Irish Acad., vol. 1, 1891, p. 469.—Egger, Abh. bay. Akad. Wiss. München, vol. 18, 1893, p. 264, pl. 5, figs. 39, 40.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 279, pl. 24, fig. 1.

Ammodiscus (*Glomospira*) *gordialis* Rzehak, Verh. k. k. geol. Reichs., 1888, p. 191.

Gordiammina gordialis Rhumbler, Nachr. Ges. Wiss. Göttingen, 1895, p. 84; Arch. Prot., vol. 3, 1903, p. 282, fig. 132 (in text).—Cushman, Bull. 71. U. S. Nat. Mus., pt. 1, 1910, p. 76, figs. 88–90 (in text).—Pearcey, Trans, Roy. Soc. Edinburgh, vol. 49, 1914, p. 1005.

Description.—Test composed of a subglobular proloculum and long undivided second chamber, at first planospiral like *Ammodiscus*, but soon leaving the one plane and becoming irregularly coiled; wall of fine arenaceous material with cement predominating; color reddish or yellowish brown.

Diameter, 0.25 to 0.90 mm.

Distribution.—This is more common than *G. charoides* and is very widely distributed. It is not found in any great numbers, however. It is known from the Arctic, from the coasts of Great Britain and France, the Mediterranean, South Atlantic, and on the western side of the North Atlantic from off Nantucket Shoals, *Albatross* D2041, 1,608 fathoms, and south of Marthas Vineyard, D2568, in 1,781 fathoms. I have seen material from seven other *Albatross* stations, four in the same general region, one off Havana, Cuba, one in the northern part of the Gulf of Mexico, and the other off Pernambuco, Brazil. Depths range from 167 to 1,608 fathoms, bottom temperatures from 36.9° to 39° F., with a single station in the Gulf of Mexico 48.6° in 227 fathoms.

Glomospira gordialis—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
9640	U.S.N.M.	1	D2029....	39 42 00 N.; 70 47 00 W.	1,168	38.5	gy. m.....	Rare.
10035	U.S.N.M	1	D2035....	39 26 16 N.; 70 02 37 W.	1,362	.....	glob. oz.....	Rare.
9641	U.S.N.M.	1	D2034....	39 27 10 N.; 69 56 20 W.	1,346	38	glob. oz.....	Rare.
9642	U.S.N.M.	2	D2160....	23 10 31 N.; 82 20 37 W.	167	.....	co.....	Rare.
9313	U.S.N.M.	1	D2221....	39 05 30 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Rare.
9314	U.S.N.M.	1	D2222....	39 03 15 N.; 70 50 45 W.	1,537	36.9	gy. oz.....	Rare.
9315	U.S.N.M.	1	D2393....	28 43 00 N.; 87 14 30 W.	525	41.1	lt. gy. m....	Rare.
9643	U.S.N.M.	4	D2398....	28 45 00 N.; 86 26 00 W.	227	48.6	gy. m.....	Rare.
9644	U.S.N.M.	1	D2761....	15 39 00 S.; 38 32 54 W.	818	39	pter. oz.....	Rare.
9353	U.S.N.M.	1	H58.....	17 45 20 N.; 65 35 35 W.	1,345	.....	oz. for.....	Rare.

GLOMOSPIRA CHAROIDES (Jones and Parker).

Plate 36, figs. 10–15.

Trochammina squamata, var. *charoides* Jones and Parker, Quart. Journ., Geol. Soc., vol. 16, 1860, p. 304.

Trochammina charoides W. B. Carpenter, Jones, and Parker, Intr. Foram., 1862, p. 141, pl. 11, fig. 3.—Siddall, Proc. Chester Soc. Nat. Sci., pt. 2, 1878, p. 5.—Haeusler, Ann. Mag. Nat. Hist., ser. 5, vol. 10, 1882, p. 56, pl. 4, fig. 21.

Ammodiscus charoides Berthelin, Foram. de Bourgneuf et Pornichet, 1878, p. 23, No. 18.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 334, pl. 38, figs. 10–16.—J. Wright, Proc. Roy. Irish Acad., vol. 1, 1891, p. 469.—Chapman, Proc. Zool. Soc. London, 1895, p. 18.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 279, pl. 24, fig. 2.

Gordiammina charoides Rhumbler, Nachr. Ges. Wiss. Göttingen, 1895, p. 84.—Kiaer, Norske Nordhavs Expedition, No. 25, 1899, p. 4.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 282, fig. 133 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 77, figs. 91–96 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1005.

Glomospira charoides Rhumbler, Foram. Plankton Exped., pt. 1, 1909, pl. 4, fig. 8; pt. 2, 1913, p. 422.

Description.—Test consisting of an ovoid or subglobular proloculum and long, undivided second chamber evenly coiled in a series of layers making a subglobular mass, then turning at right angles to its preceding axis and making finally a partial or even complete revolution about the earlier formed globular test; wall finely arenaceous with a predominance of cement; surface smooth and polished; color usually reddish brown.

Diameter, up to 0.5 mm.

Distribution.—This is a very widely distributed species, never so far as I have seen, occurring in any considerable numbers. On the European side it is known from the Mediterranean, Bay of Biscay, Faroe Channel, and west of Scotland and about the British Isles. Flint records a single station, D2041, 1,608 fathoms, south of Georges Banks, and I have found the species in the same general region at the same station and at several other *Albatross* stations.

Glomospira charoides—material examined.

Cat. No.	Coll. of—	No. of specimens.	Station.	Locality.	Depth in fathoms.	Bottom temperature.	Character of bottom.	Abundance.
				° ′ ″ ° ′ ″		°F.		
	U.S.N.M.	1	D2036....	38 52 40 N.; 69 24 40 W.	1,735	38	glob. oz.....	Rare.
9639	U.S.N.M.	.....	D2041....	39 22 50 N.; 68 25 00 W.	1,608	38	glob. oz.....	Rare.
9309	U.S.N.M.	1	D2221....	39 05 20 N.; 70 44 30 W.	1,525	36.9	gy. oz.....	Rare.
9310	U.S.N.M.	2	D2222....	39 03 15 N.; 70 50 45 W.	1,537	36.9	gy. oz.....	Rare.
9311	U.S.N.M.	4	D2393....	28 43 00 N.; 87 14 30 W.	525	41.1	lt. gy. m....	Rare.
9312	U.S.N.M.	2	D2550....	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.....	Few.

Genus TURRITELLELLA Rhumbler, 1903.

Trochammina (part) Siddall (type, *Trochammina shoneana* Siddall), Proc. Chester Soc. Nat. Sci., pt. 2, 1878, p. 46.

Ammodiscus (part) Siddall, Cat. Brit. Foram., 1879, p. 5.—Balkwill and Millett, Journ. Micr., vol. 3, 1884, p. 25.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 335.

Turritellopsis Rhumbler (not of G. O. Sars, 1878), Nachr. Ges. Wiss. Göttingen, 1895, p. 84.

Turritellella Rhumbler, Arch. Prot., vol. 3, 1903, p. 283.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 78.

Description.—Test free, consisting of a proloculum and long, undivided second chamber, coiled in an elongate, close spiral, wall composed of sand grains and much cement, smooth; aperture, the open end of the tubular chamber.

Recognizing the considerable differences between these and the other species included under *Ammodiscus*, Rhumbler proposed *Turritellella* for the species following. It seems very distinctive and may include *T. spectabilis* (H. B. Brady).

TURRITELLELLA SHONEANA (Siddall).

Plate 38, figs. 5–7.

Trochammina shoneana Siddall, Proc. Chester Soc. Nat. Sci., pt. 2, 1878, p. 46, figs. 1, 2.

Ammodiscus shoneanus Siddall, Cat. Brit. For., 1879, p. 5.—Balkwill and Wright, Proc. Roy. Irish Acad., vol. 3, 1882, p. 546; Journ. Micr., vol. 3, 1884, p. 25, pl. 1, fig. 4.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 335, pl. 38, figs. 17–19.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, No. 64, 1913, p. 49, pl. 3, fig. 6; Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 227.

Turritellopsis shoneanus Rhumbler, Nachr. Ges. Wiss. Göttingen, 1895, p. 84; Zeitschr. allg. Phys., vol. 2, 1902, p. 284, fig. 103.

Turritella shoneana Rhumbler, Arch. Prot., vol. 3, 1903, p. 283, fig. 135 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 79, figs. 107–109 (in text).

Description.—Test free, composed of a proloculum and a long undivided tubular second chamber, in a close coiled, elongate spiral, of nearly uniform diameter, wall finely arenaceous, with much cement, rounded open end of the tubular chamber serving as the aperture, color reddish brown.

Length, 0.25–0.5 mm.

Distribution.—In the North Sea and about the British Isles this species has been recorded a number of times in comparatively shallow water. Rhumbler records it from comparatively shallow water off the Cape Verde Islands. The *Challenger* obtained it from comparatively shallow water off Kerguelen Island and again in very deep water of the North Pacific, 3,950 fathoms. I have material kindly sent me by Mr. Joseph Wright, of Belfast, Ireland, from Rockport, Belfast Lough, between tides, but I have found no specimens in the material I have examined from this side of the Atlantic.

Heron-Allen and Earland mention the finding of the megalospheric form only in the Clare Island region and the fact that the material figured in part by Brady seems to be microspheric.

TURRITELLELLA SPECTABILIS (H. B. Brady).

Plate 38, figs. 1–4.

Ammodiscus spectabilis H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 51; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 336, pl. 38, figs. 20–22.

Turritellella spectabilis Rhumbler, Arch. Prot., vol. 3, 1903, p. 283, fig. 134 (in text).

This species is described by Brady as follows:

Test free; composed of a nonseptate tube wound upon itself, not regularly and symmetrically, so as to retain a rectilinear contour, but in curved or twisted fashion, so as to form an arcuate or subhelicoid test. Shell wall very thin; exterior somewhat rough, interior smooth and polished. Longer diameter, one-fifth inch (5 mm.) or more.

Distribution.—The types of the species are from one of the *Porcupine* stations, in 358 fathoms, off the British Isles and similar specimens more or less injured and therefore not clearly identifiable from the *Challenger* material in the south Atlantic off Buenos Aires in 1,900 fathoms.

The figured specimen (pl. 38, fig. 1) is from the type station in the collection of the United States National Museum received from Doctor Carpenter.

The large size with the thin fragile test and peculiar type of irregular coiling distinguish it from other known species.

EXPLANATION OF PLATES.

Plate 1.

Fig. 1. *Astrorhiza limicola.* × 8. (After Brady.)
2. *Astrorhiza limicola.* × 8. Specimen laid open to show the interior. (After Brady.)

Plate 2.

Figs. 1–3. *Astrorhiza arenaria.* × 15. Photographs of three variously shaped specimens.

Plate 3.

Fig. 1. *Astrorhiza arenaria.* × 15. Photograph of broad flattened specimen.
2. *Astrorhiza angulosa.* × 15. Photograph of quadrate specimen.

Plate 4.

Figs. 1–3. *Astrorhiza angulosa.* × 10. Photographs of variously shaped specimens.

Plate 5.

Figs. 1–3. *Astrorhiza vermiformis.* × 15. Photographs of dried specimens showing the characteristic cracks of the exterior.
4. *Astrorhiza granulosa.* ×15. Photograph of typical specimen.

Plate 6.

Fig. 1. *Rhabdammina abyssorum.* × 15. Photograph of quadrate specimen.
2–5. *Rhabdammina cornuta.* × 15. Photographs of irregular short-armed specimens.
6. *Astrorhiza vermiformis.* × 5. Type figure. (After Goës.)

Plate 7.

Fig. 1. *Rhabdammina abyssorum.* × 15. Photograph of four armed specimen.
2–5. *Rhabdammina linearis.* × 15. Photographs of specimens of the somewhat slender irregular form.

PLATE 8.

FIG. 1. *Rhabdammina irregularis.* × 10. (After Brady.)
2, 3. *Marsipella elongata.* × 15. Photographs of two specimens with a large percentage of sponge spicules.
4–6. *Marsipella cylindrica.* × 15. Photographs of specimens with rather more sand grains than usnal for this species.

PLATE 9.

(After Heron-Allen and Earland.)

FIG. 1. *Technitella legumen.* Showing external surface of test.
2. *Technitella legumen.* Section of test showing internal surface.
3. *Psammosphaera rustica.* Type-specimen.
4. *Psammosphaera rustica.* Abnormal double specimen.
5. *Psammosphaera bowmanni.* Type-specimen, side view.
6. *Psammosphaera bowmanni.* End view.
7. *Marsipella spiralis.* Type-specimen.
8. *Marsipella cylindrica.* Specimen showing club-shaped end.
9. *Marsipella cylindrica.* A fragment of a specimen, showing a spiral arrangement of the constituent sponge spicules.
All figures × 40.

PLATE 10.

(After Heron-Allen and Earland.)

FIG. 1. *Technitella legumen.* Showing the differential arrangement of the sponge spicules in the external and internal layers. The interstitial cement is represented by the shading. × 140.
2. *Psammosphaera rustica.* × 40.
3. *Psammosphaera rustica.* An abnormal triple specimen. × 40.
4. *Psammosphaera rustica.* Detail showing the method of construction in a "panel" of the test. The central space has been filled in by a fragment of a triaxial sponge spicule. The interstitial cement is represented by dark shading. × 140.
5. *Psammosphaera bowmanni.* × 40.
6. *Marsipella spiralis.* × 40.
7. *Marsipella spiralis.* Detail showing the loosely constructed terminal crown. The constituent spicules are not embedded in cement. × 95.
8. *Marsipella cylindrica.* Specimen showing club-shaped end and elongated spicules. × 40.
9. *Marsipella cylindrica.* Enlarged view of end showing details of construction. 95.

PLATE 11.

FIG. 1. *Rhabdammina discreta.* × 12.
2, 3. *Rhizammina algaeformis.* × 40.
4. *Bathysiphon filiformis.* × 12.
5. *Bathysiphon filiformis.* × 12. The lower portion showing the central cavity and the thickness of the wall.

PLATE 12.

FIG. 1. *Bathysiphon argenteus.* Type-specimen. × 75. (After Heron-Allen and Earland.)
2. *Bathysiphon argenteus.* A portion of the tube. × 200. (After Heron-Allen and Earland.)
3. *Bathysiphon argenteus.* A portion of the tube viewed as a transparent object. × 650. (After Heron-Allen and Earland.)
4–6. *Psammosphaera parva.* × 35. Photographs of specimens each with a single large sponge spicule.
7–10. *Rhizammina indivisa.* Photographs of specimens. × 15.

PLATE 13.

FIGS. 1–5. *Psammosphaera fusca*. Photographs of specimens composed of small black rounded pebbles and light colored cement. × 15.

6. *Psammosphaera fusca*. × 15. Larger specimen attached to *Rhabdammina*.

PLATE 14.

FIGS. 1–3. *Psammosphaera fusca*. × 15. Photographs of specimens composed of fine material attached to *Rhabdammina*.

PLATE 15.

FIGS. 1, 2. *Psammosphaera testacea*. × 15. Photographs of specimens largely composed of tests of *Pulvinulina menardii*.

3. *Psammosphaera testacea*. × 20. Section showing the single layer of tests and the central cavity.

4, 5. *Sorosphaera confusa*. Photographs of irregular specimens. × 20.

6–8. *Storthosphaera albida*. × 15. Photographs of exterior showing the irregular crests characteristic of this species.

PLATE 16.

FIGS. 1, 2. *Storthosphaera albida*. × 20. Exterior views of especially strongly cervicorn specimens. (After Brady.)

3. *Storthosphaera albida*. × 20. Specimen sectioned to show the wall and chamber cavity. (After Brady.)

4. *Saccammina sphaerica*. × 15. Elongate fusiform specimen with two apertures. (After Brady.)

5. *Saccammina sphaerica*. × 15. Side view of specimen. (After Brady.)

6. *Technitella melo*. × 50. *a*, side view; *b*, apertural view. (After Brady.)

7. *Technitella legumen*. × 50. Side view. (After Brady.)

8. *Technitella legumen*. × 30. Side view of larger more regular specimen. (After Brady.)

PLATE 17.

FIG. 1. *Rhaphidoscene conica*. Specimen attached to *Botellina*. Copy of type figure. *a*, *b*, front and side views. (After Vaughan-Jennings.)

PLATE 18.

FIG. 1. *Storthosphaera elongata*. × 15. Photograph of exterior of specimen.

2. *Storthosphaera elongata*. × 15. Sectioned specimen showing thick matted wall and central chamber cavity.

PLATE 19.

FIG. 1. *Storthosphaera elongata*. × 15. Photograph of shorter specimen.

2–5. *Saccammina sphaerica*. × 15. Photographs of spherical specimens with large circular apertures referred to this species.

6, 7. *Proteonina micacea*. Photographs of specimens composed of mica scales.

8. *Lagenammina lagunculu*. × 25. Figures of specimens. (After Rhumbler.)

PLATE 20.

FIGS. 1–4. *Proteonina testacea*. × 15. Photographs of specimens composed of tests of *Pulvinulina* and *Globigerina* with abundant cement.

5. *Saccammina minuta*. × 25. Figure after Rhumbler.

6. *Proteonina helenae*. × 75. Specimen composed of fragments of tests of *Globigerina* and other foraminifera. (After Rhumbler.)

7. *Proteonina helenae*. × 75. Specimen by transmitted light composed largely of entire tests of other foraminifera. (After Rhumbler.)

PLATE 21.

FIG. 1. *Proteonina difflugiformis.* × 50. Specimen composed of large fragments of other foraminiferal tests. (After Rhumbler.)
2. *Proteonina difflugiformis.* × 50. Specimen composed of fine fragments. (After Rhumbler.)
3. *Pelosina parca.* × 75. (After Rhumbler.)
4. *Pelosina rotundata.* × 20. Small specimen with elongate neck. (After Brady.)
5. *Pelosina rotundata.* × 20. Larger specimen. (After Brady.)
6. *Pelosina rotundata.* × 20. Sectional specimen showing thick wall and comparatively small central cavity. (After Brady.)

PLATE 22.

FIGS. 1–4. *Pelosina variabilis.* × 15. Photographs of irregular elongate specimens.
5. *Pelosina cylindrica.* × 15.

PLATE 23.

FIG. 1. *Pelosina arborescens.* × 2. Figure of entire specimen with its branching arms. (After Pearcey.)
2. *Pelosina arborescens.* × 4. *a*, side view; *b*, sectional view. (After Pearcey.)
3, 4. *Hippocrepina indivisa.* × 45. Side views. (After Brady.)
5. *Hippocrepina indivisa.* × 45. Longitudinal section showing undivided cavity and comparatively thin wall. (After Brady.)
6, 7. *Hippocrepina indivisa.* × 45. Apertural views showing the raised lip. (After Brady.)

PLATE 24.

FIGS. 1, 2. *Technitella thompsoni.* × 75. Side views showing the test composed of echinoderm plates. (After Heron-Allen and Earland.)
3–5. *Technitella legumen.* × 15. Photographs of exterior.

PLATE 25.

FIGS. 1–3. *Webbinella hemisphaerica.* × 15. Photographs of specimens attached to black pebbles.
4. *Crithionina pisum.* × 15. Section showing thickness of wall and central cavity.
5. *Crithionina pisum.* × 15. Photograph of exterior.
6. *Tholosina bulla.* × 15. Photograph of specimen attached to *Rhabdammina.*

PLATE 26.

FIGS. 1, 2. *Crithionina pisum.* × 15. Photographs of exterior.
3. *Crithionina pisum.* × 15. Photograph showing thickness of wall and central cavity.
4. *Crithionina pisum*, var. *hispida.* × 15. Photograph of exterior.
5. *Technitella legumen.* Showing the central cavity and wall with the interior spicules arranged horizontally, the outside ones vertically. × 15. (After Goës.)
6, 7. *Crithionina granum.* × 12. Exterior of two specimens. (After Goës.)

PLATE 27.

FIG. 1. *Crithionina mamilla.* × 15. Photograph of exterior.
2. *Crithionina mamilla.* × 15. Photograph of sectional specimen showing comparatively small central cavity and radiating tubules.

PLATE 28.

FIG. 1. *Thurammina cariosa*. × 15. Photograph of exterior
2. *Thurammina favosa*. × 15. Photograph showing wall, central cavity, and apertures.
3. *Thurammina favosa*. × 15. Photograph of exterior.
4–8. *Thurammina albicans*. × 50. (After Brady.) Fig. 5, section showing thickness of wall and size of central cavity.
9. *Thurammina compressa*. × 50. (After Brady.) *a*, from above; *b*, from side.
10. *Thurammina papillata*. × 50. (After Brady). Three chambers adhering.
11. *Thurammina papillata*. × 30. Exterior view. (After Brady.)
12. *Crithionina mamilla*. × 15. Photograph of exterior.

PLATE 29.

FIGS. 1–3. *Hyperammina friabilis*. × 15. Photographs of exterior. Fig. 2 showing thickness of wall and part of cavity.
4. *Hyperammina elongata*. × 15. Photograph of exterior.
5, 6. *Hyperammina laevigata*. × 15. Photograph of exterior.
7, 8. *Hyperammina subnodosa*. × 15. Photograph of exterior.

PLATE 30.

FIG. 1. *Psammatodendron arborescens*. × 20. (After Brady.)
2. *Psammatodendron arborescens*. × 100. Terminal branch with aperture. (After Brady.)
3. *Saccorhiza ramosa*. × 15. Photograph of specimen with proloculum.
4. *Saccorhiza ramosa*. × 15. Photograph of irregular branching portion.

PLATE 31.

FIG. 1. *Syringammina fragilissima*. Natural size. *a*, side view of a fragment representing about half an entire specimen; *aa*, original surface of specimen; *b*, ventral view of same specimen, showing uneven fractured surface near the middle of the test; dotted line shows approximately the original outline of the test. (After Brady.)
2. *Syringammina fragilissima*. × 8. Portion of a radial section, showing at *c* one of the smaller secondary canals, and at *cc* one of the concentric reticulated partitions. (After Brady.)
3. *Dendrophrya radiata*. × 45. Exterior of specimen. (After Brady.)

PLATE 32.

FIGS. 1, 2. *Jaculella acuta*. × 12. Exterior. (After Brady.)
3, 4. *Jaculella acuta*. × 15. Photographs of exterior.
5. *Jaculella obtusa*. × 12. Exterior. (After Brady.)
6, 7. *Dendrophrya radiata*. × 40. (After Brady.)

PLATE 33.

FIG. 1. *Haliphysema tumanowiczii*. × 50. Single specimen. (After Brady.)
2. *Haliphysema tumanowiczii*. × 20. Group of attached specimens. (After Brady.)
3. *Dendrophrya erecta*. × 30. Two specimens. (After Brady.)
4. *Dendrophrya erecta*. × 25. Single, much branched specimen. (After Brady.)

PLATE 34.

FIG. 1. *Haliphysema ramulosum*. × 20. (After Brady.)
2. *Ammolagena clavata*. × 60. Specimen broken away showing the thin lower surface. (After Brady.)

3. *Ammolagena clavata.* × 15. Photograph of microspheric specimen with narrow elongate proloculum.
4. *Ammolagena clavata.* × 15. Photograph of megalospheric specimen with nearly circular proloculum.
5. *Ammolagena clavata.* × 15. Photograph of broken specimen showing thin wall of proloculum attached to shell.

PLATE 35.

FIGS. 1–3. *Ammolagena clavata.* × 30. Photographs of specimens attached to shell fragments.
4, 5. *Girvanella vagans.* × 20. Photographs of specimens attached to tubes of *Rhabdammina.*

PLATE 36.

FIG. 1. *Girvanella vagans.* × 15. Photograph of specimen with proloculum.
2. *Girvanella schaudinni.* × 15.
3. *Amodiscoides turbinatus.* × 15. Photograph, dorsal view.
4. *Ammodiscoides turbinatus.* × 15. Side view.
5. *Ammodiscoides turbinatus.* × 15. Dorsal view of small specimen.
6. *Ammodiscoides turbinatus.* × 15. Ventral view.
7–9. *Glomospira gordialis.* × 70. (After Brady.)
10. *Glomospira charoides.* × 70. Broken specimen showing several coils. (After Brady.)
11. *Glomospira charoides.* × 70. Longitudinal section of test. (After Brady.)
12–15. *Glomospira charoides.* × 70. (After Brady.).

PLATE 37.

Ammodiscoides turbinatus.

FIG. 1. Complete specimen. × 20.
2. Younger specimen. × 45.
3. Apertural view of a still younger specimen showing the conical young. × 60.
4. The young portion of the test without the later coils. × 75.
5, 6. Diagrammatic sections showing the reversing of the conical form in the late coils × 45. × 60.

PLATE 38.

FIG. 1. *Turritellella spectabilis.* × 15. Photograph of specimen in United States National Museum received from Doctor Carpenter.
2, 3. *Turritellella spectabilis.* × 12. External view. (After Brady.)
4. *Turritellella spectabilis.* × 12. Sectioned specimen. (After Brady.)
5–7. *Turritellella shoneana.* × 100. *a*, *a*, side view; *b*, *b*, apertural views. (After Brady.)

PLATE 39.

Ammodiscus incertus.

FIGS. 1–4. Microspheric specimens, the centers consisting of a microspheric proloculum and numerous fine coils. × 15.
5–7. Megalospheric specimens, the centers consisting of a megalospheric proloculum and a few broad coils. × 15.
8. Sectioned specimen, microspheric form. × 15. (After Brady.)

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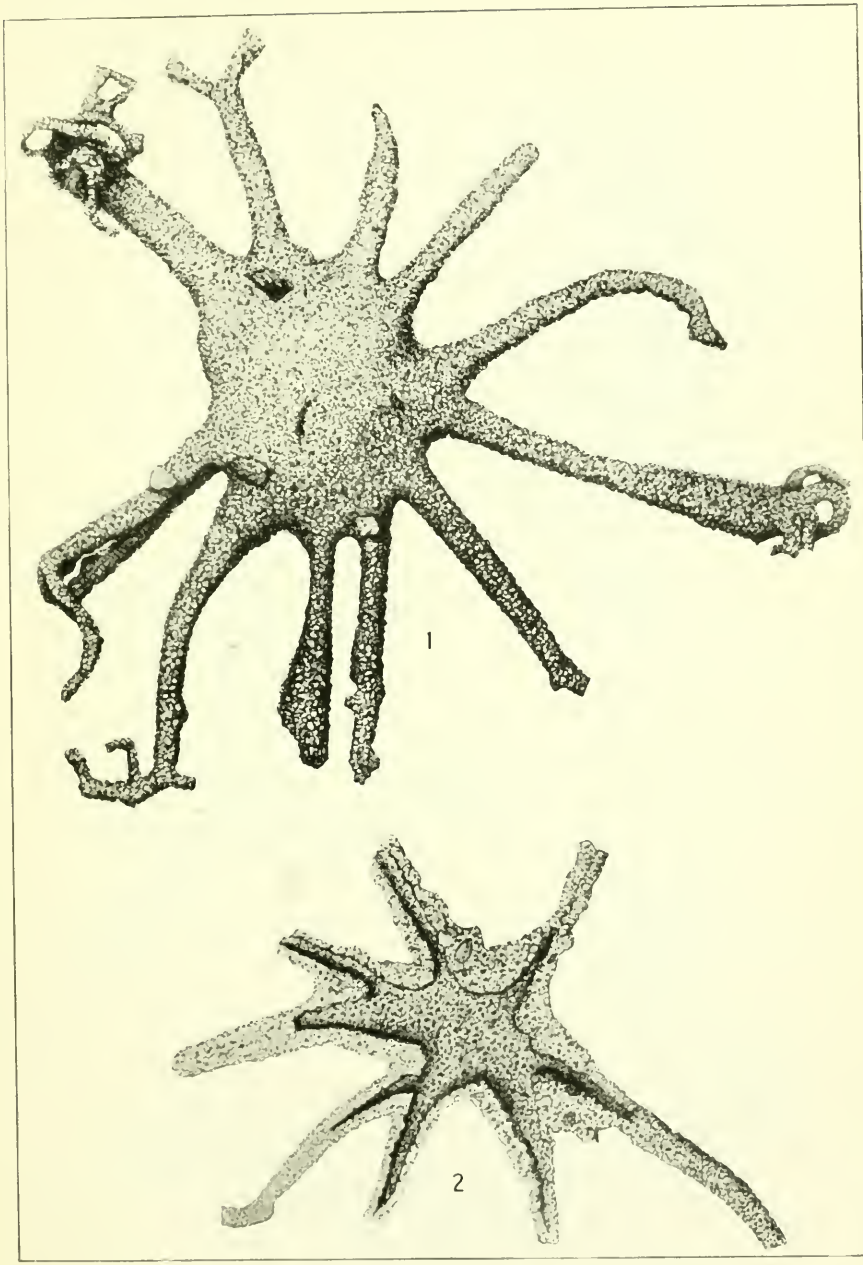
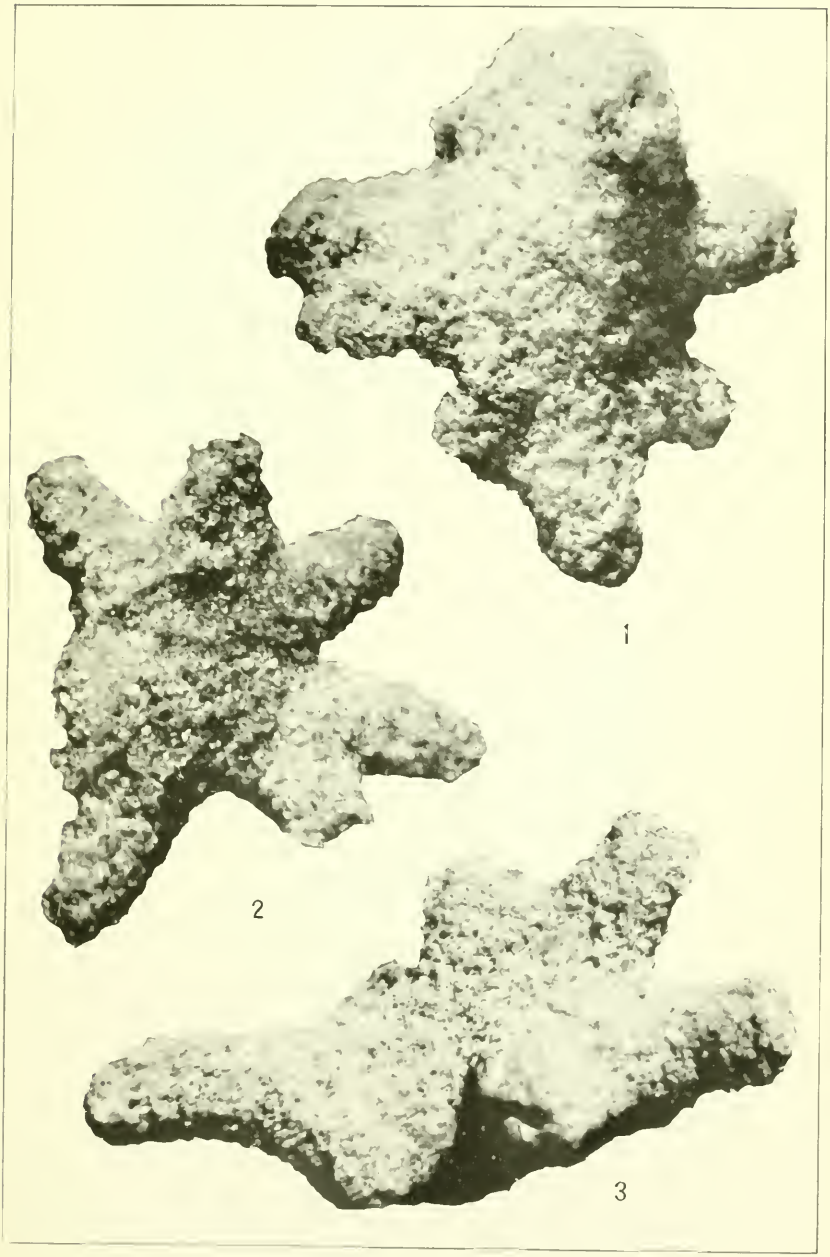


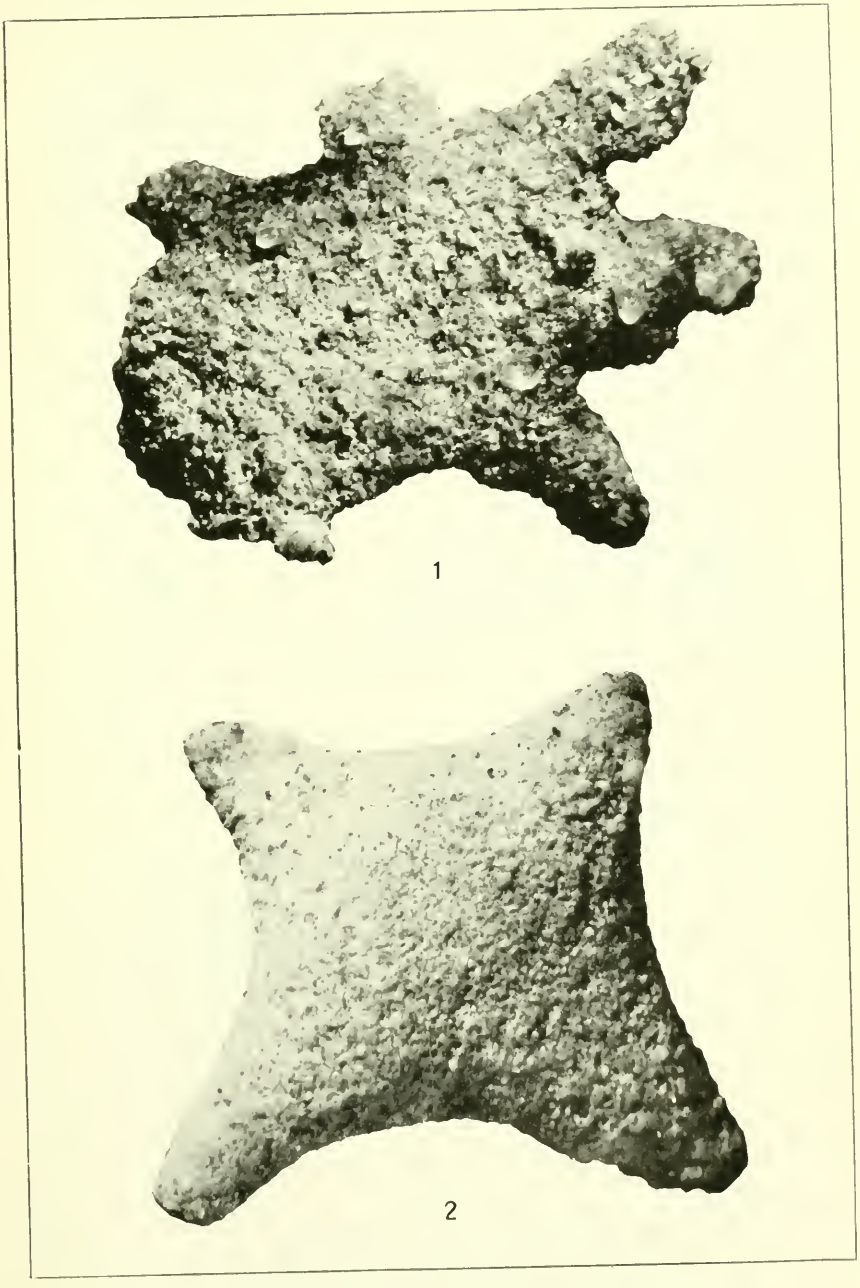
ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGE 103



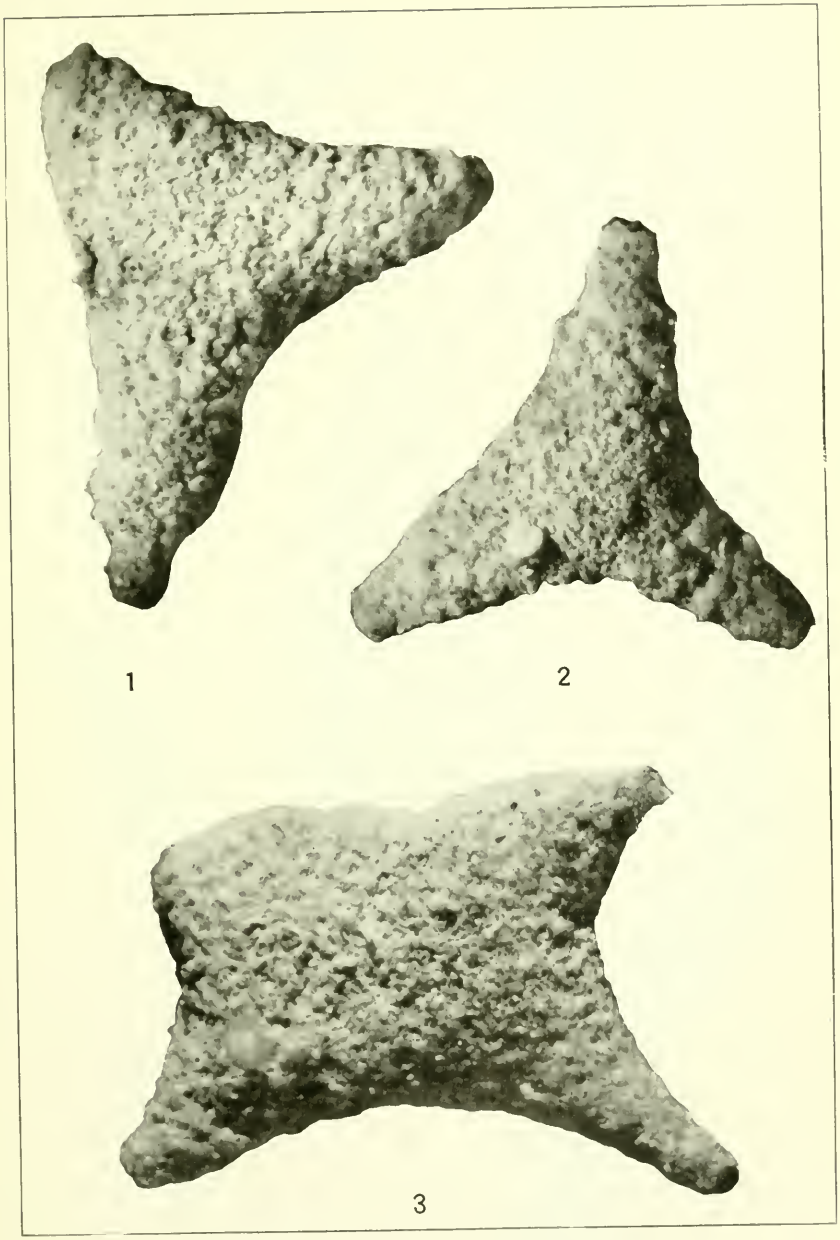
ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGE 103.



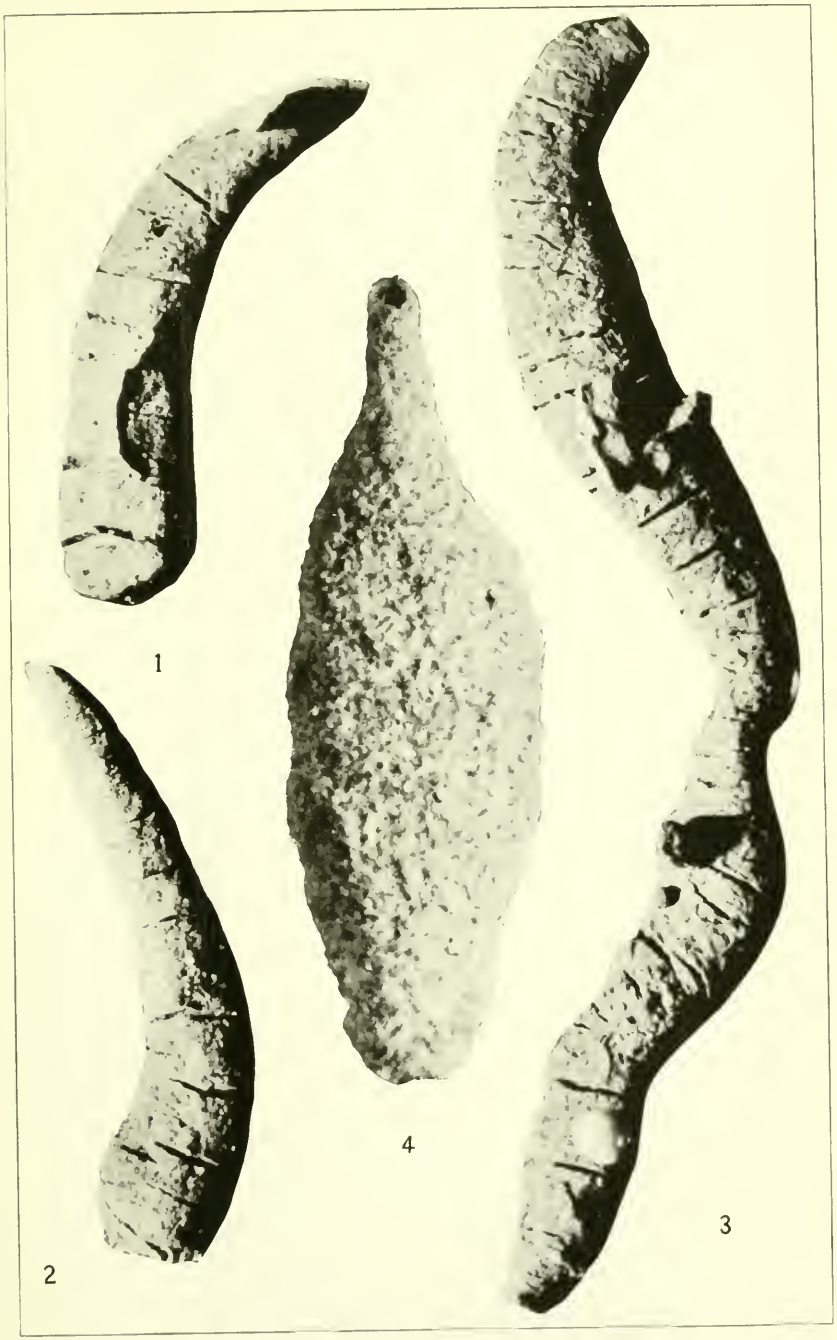
ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGE 103.



ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGE 103.



ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

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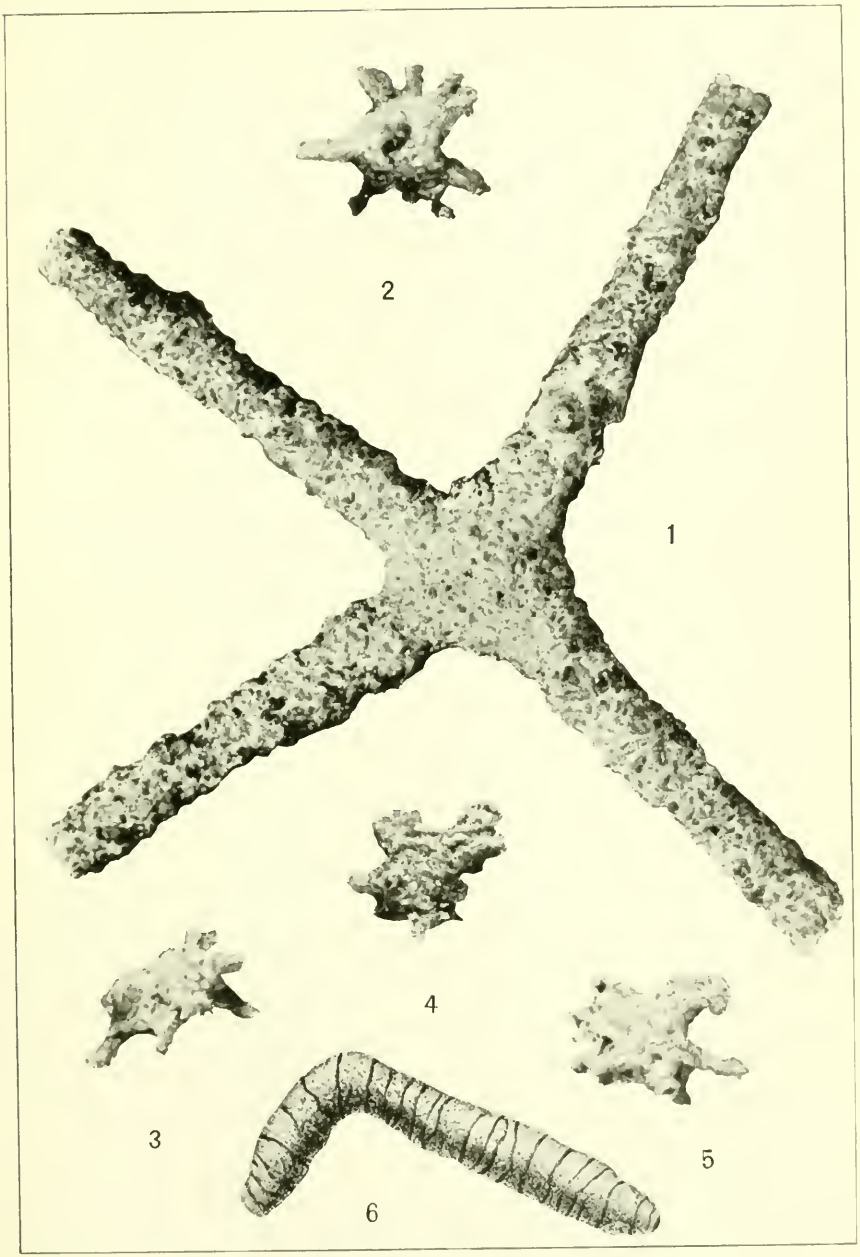

ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

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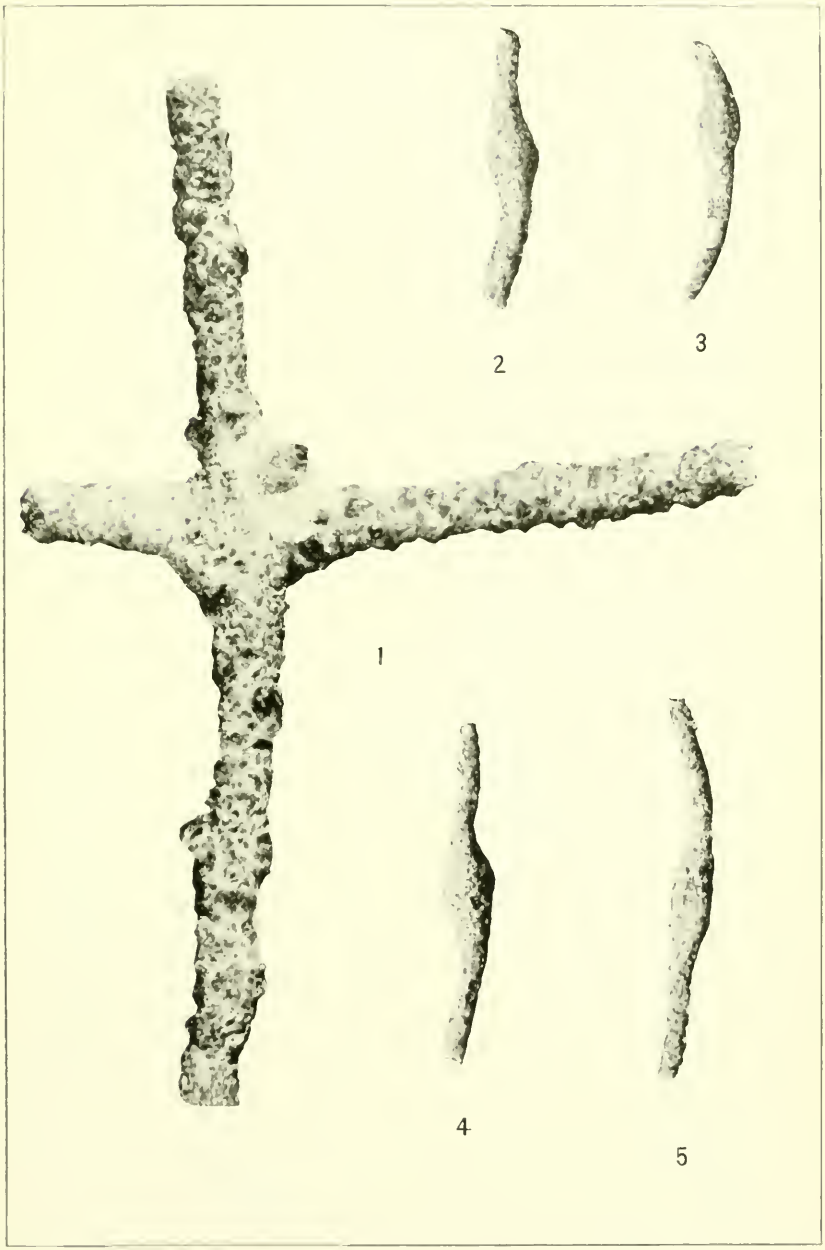

ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

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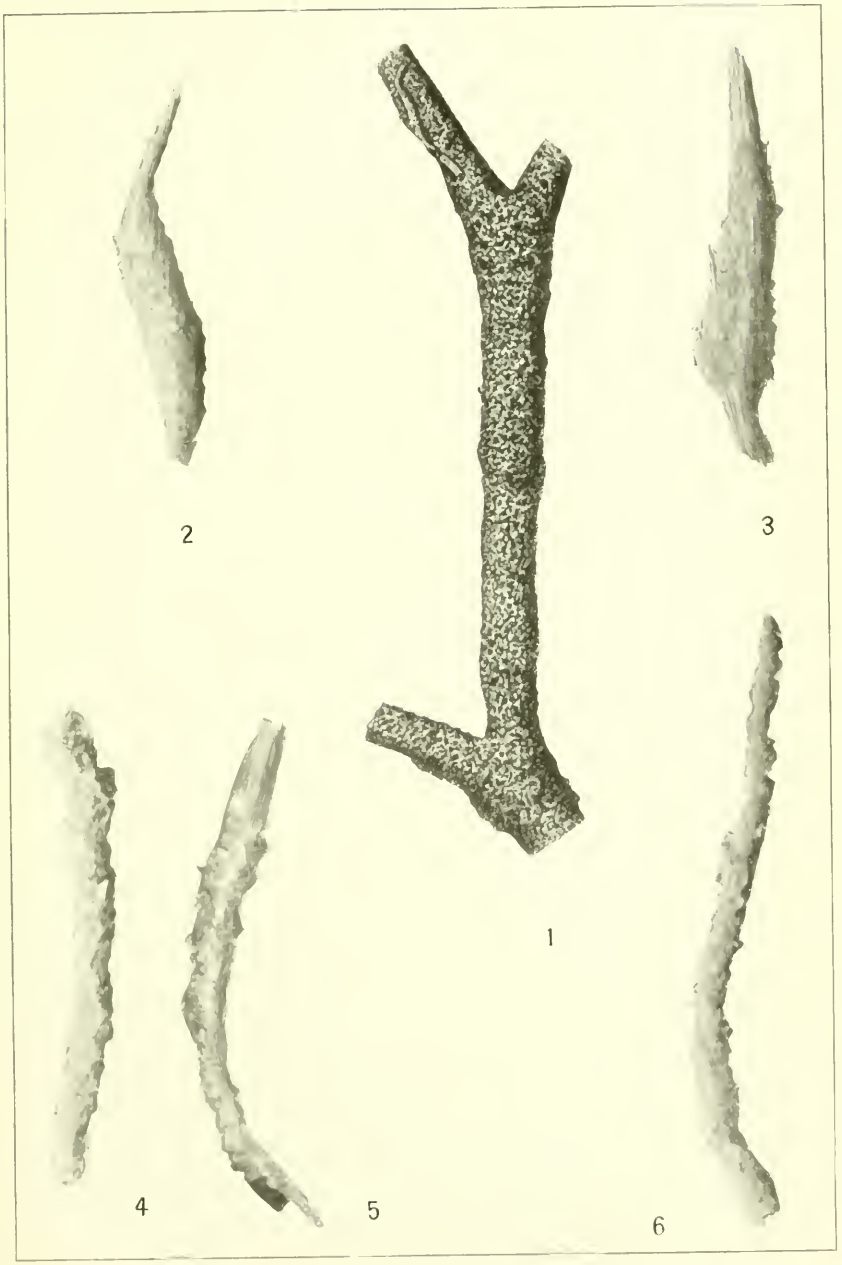

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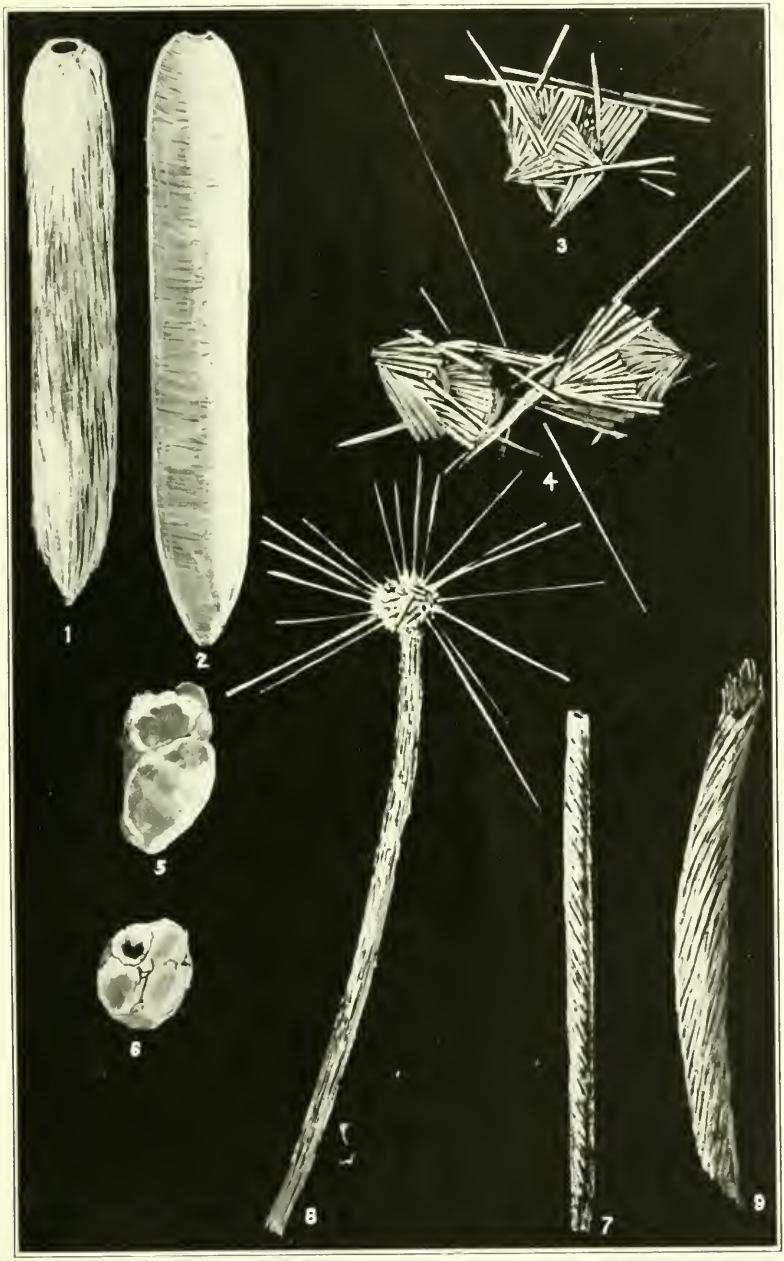

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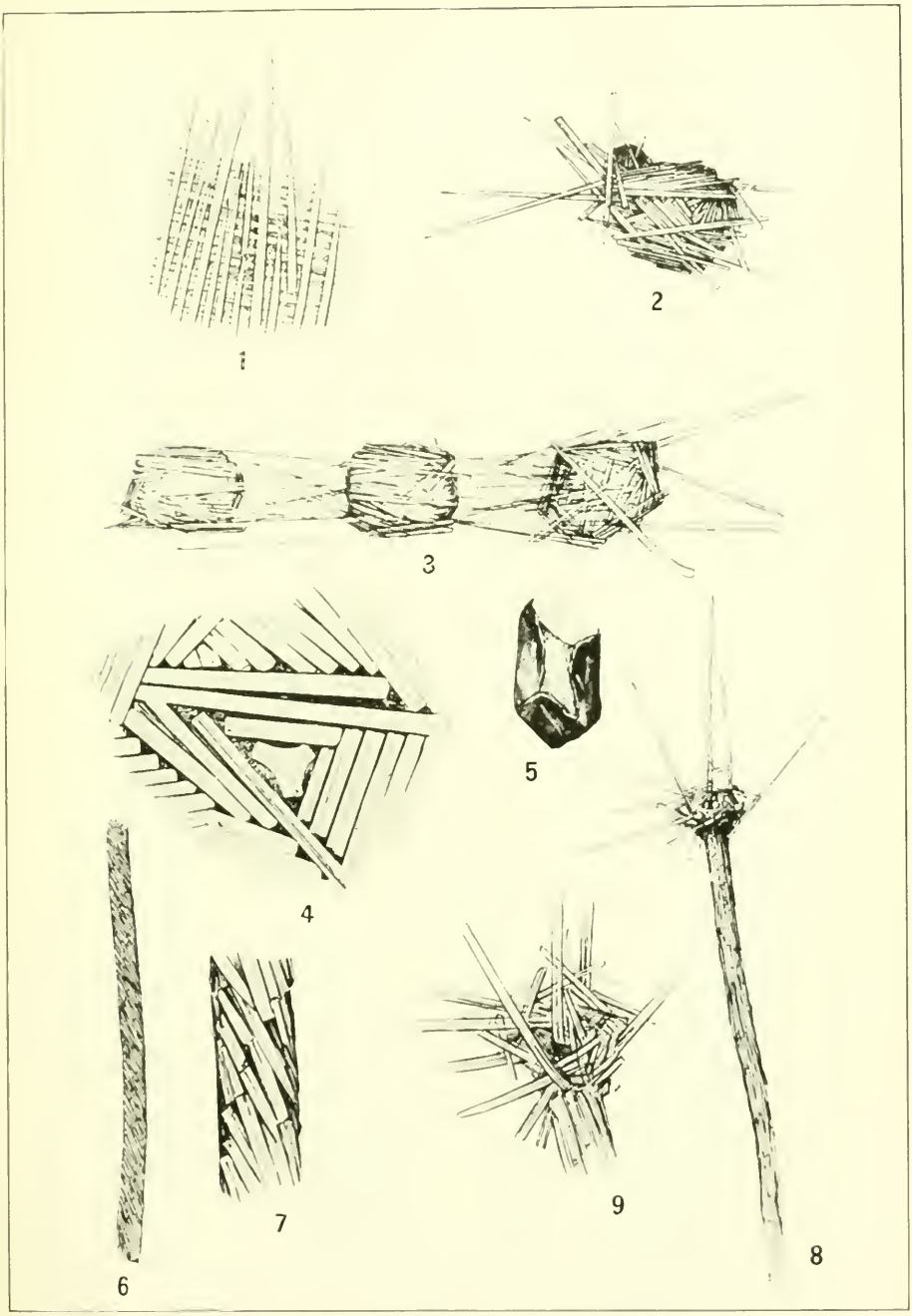

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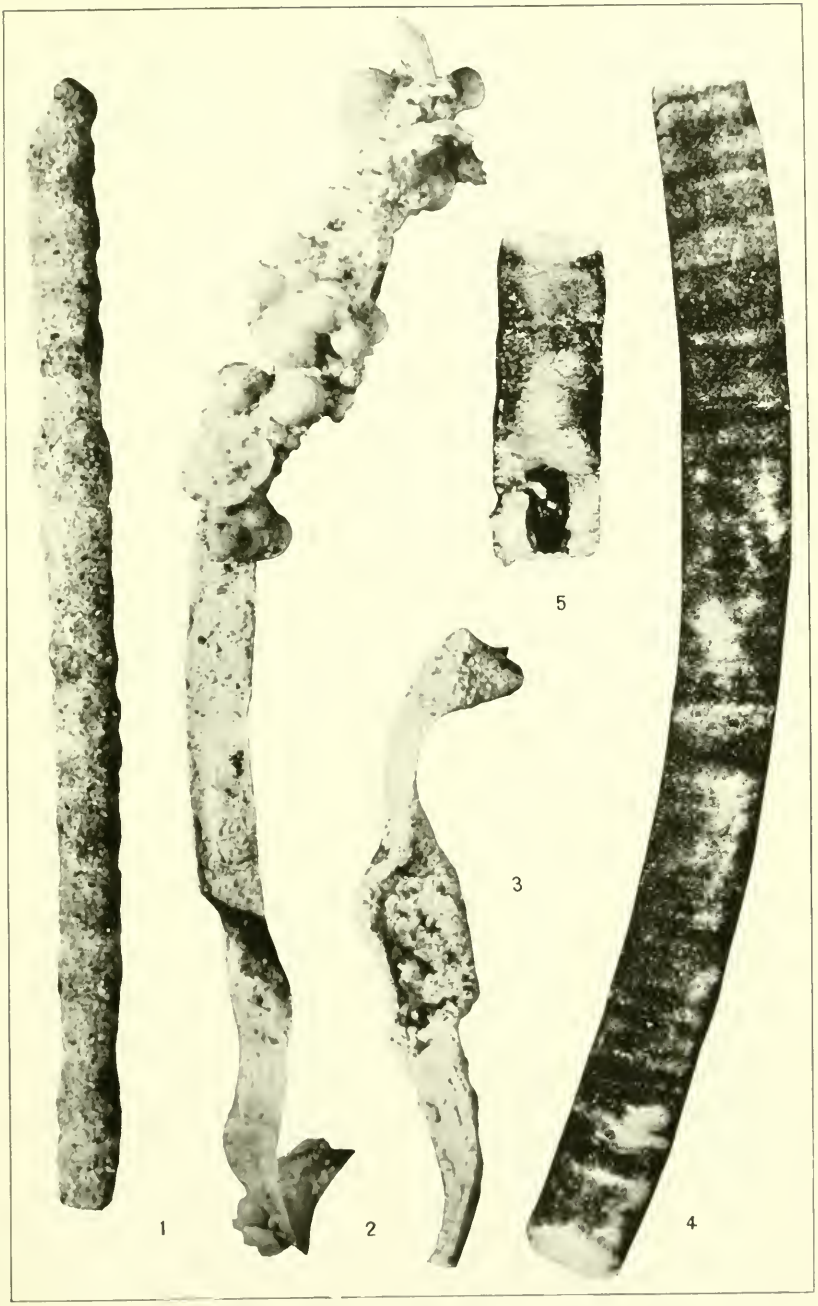

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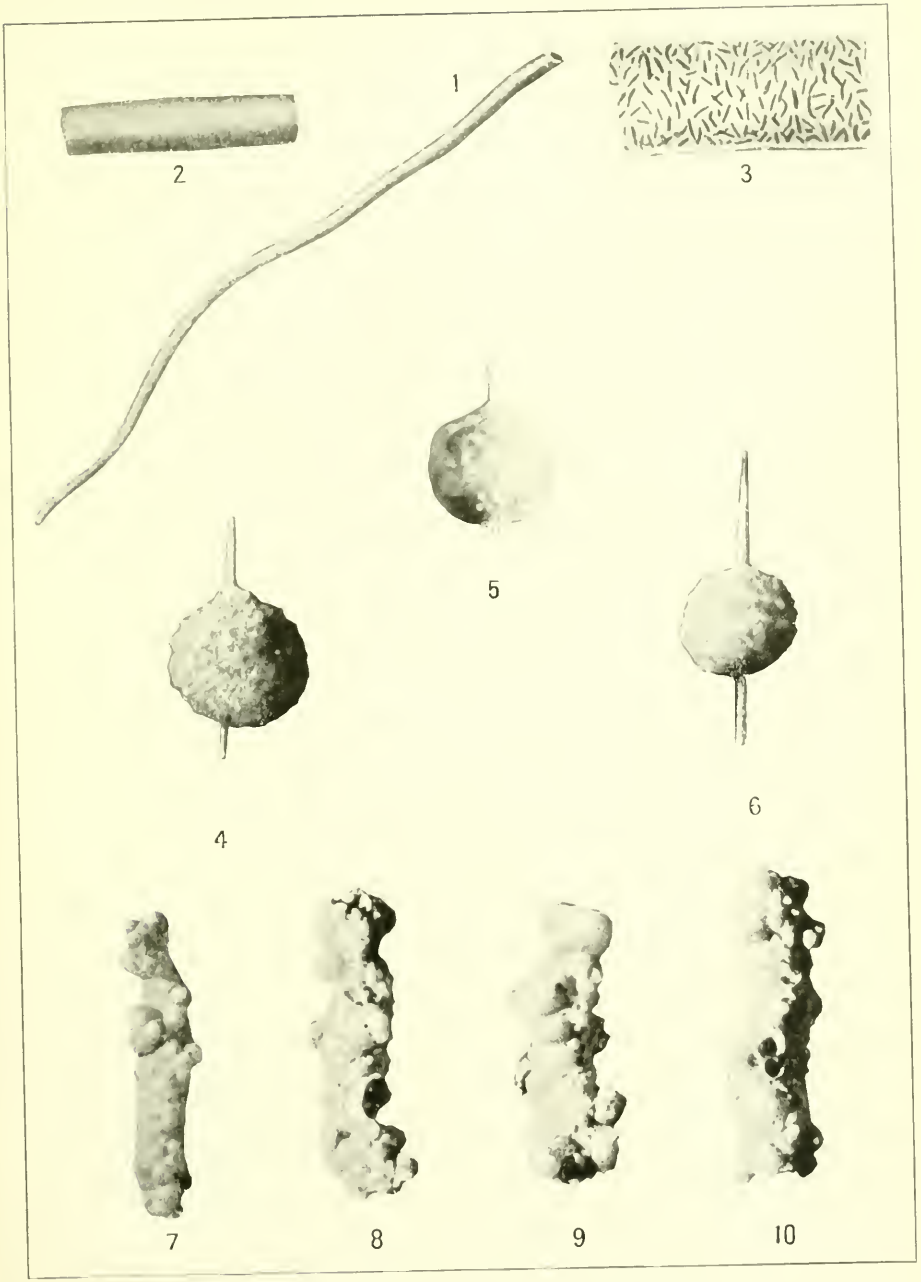

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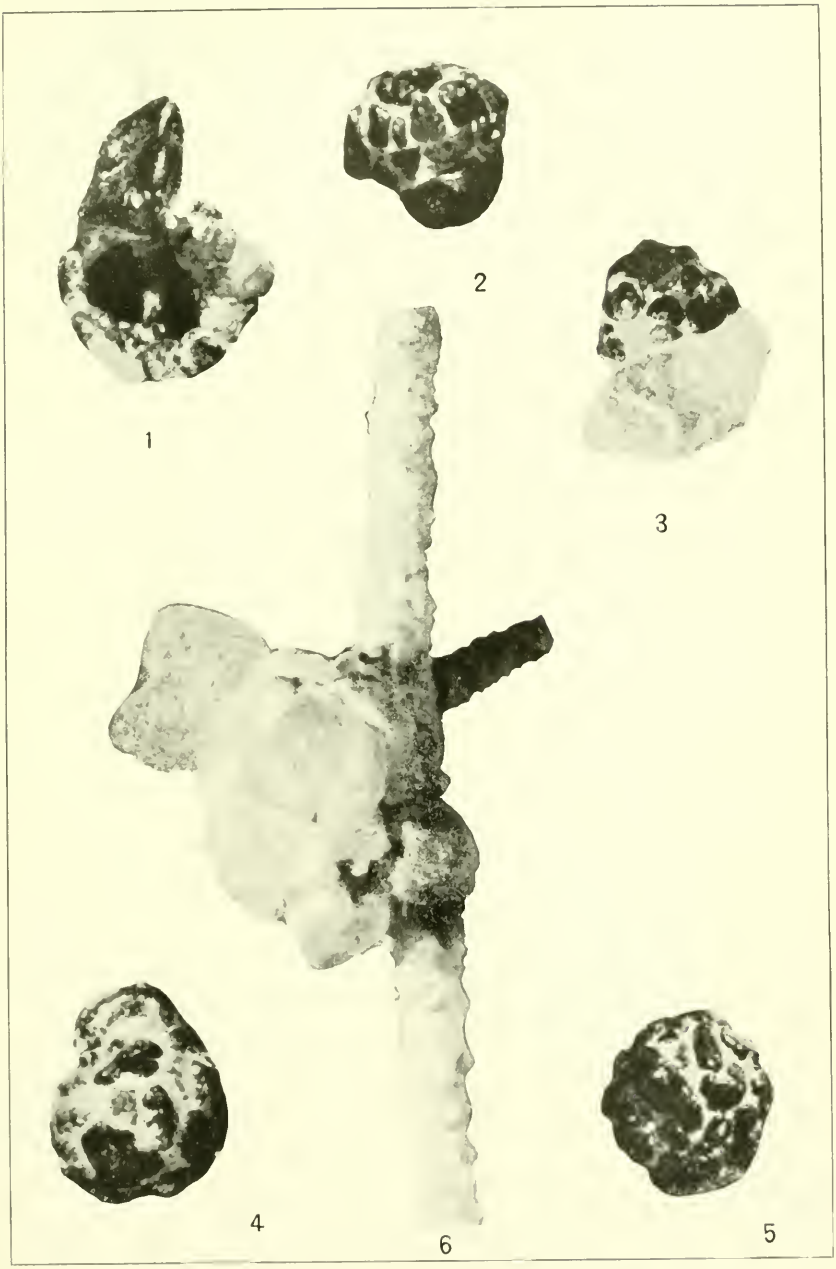

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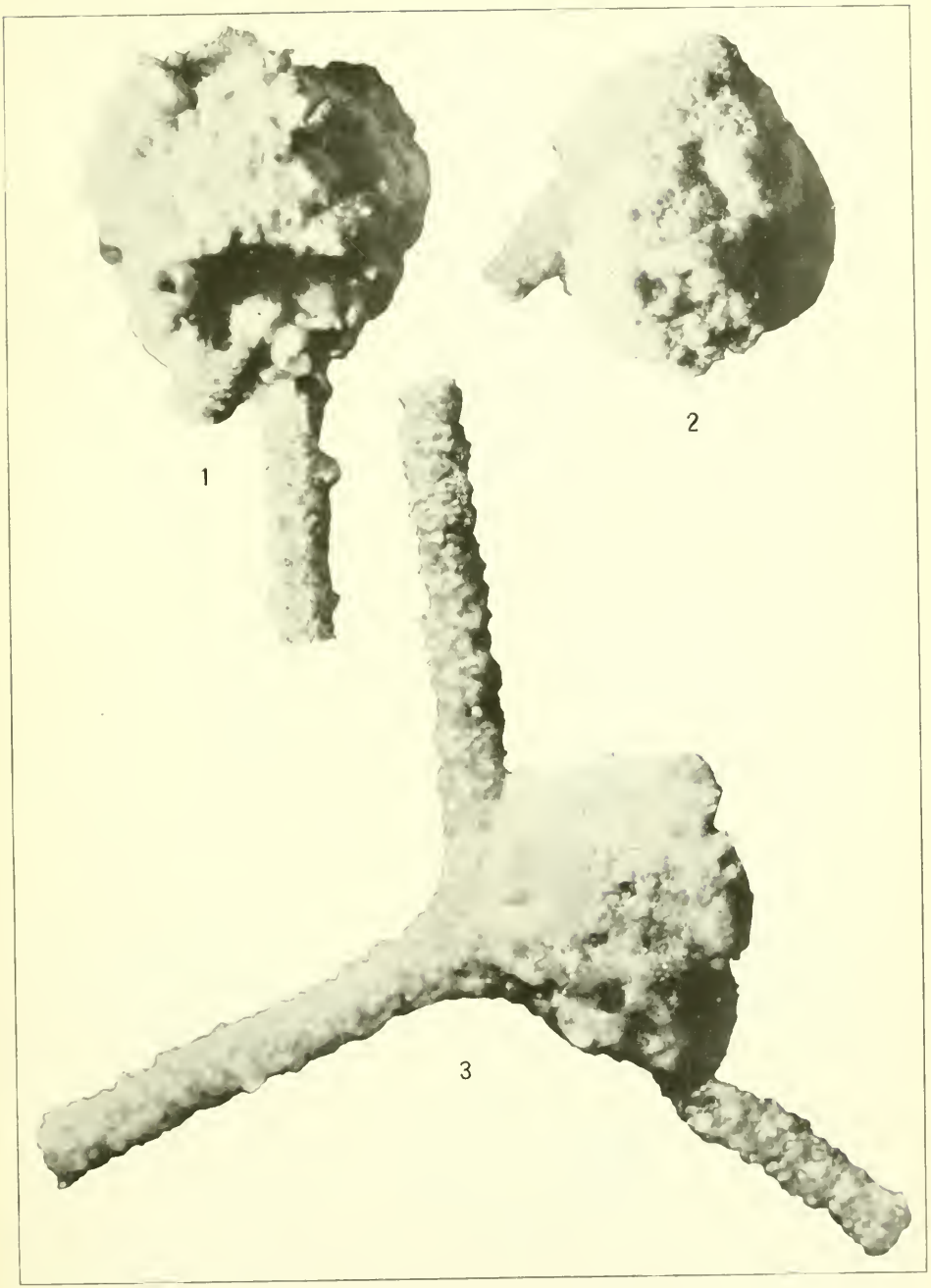

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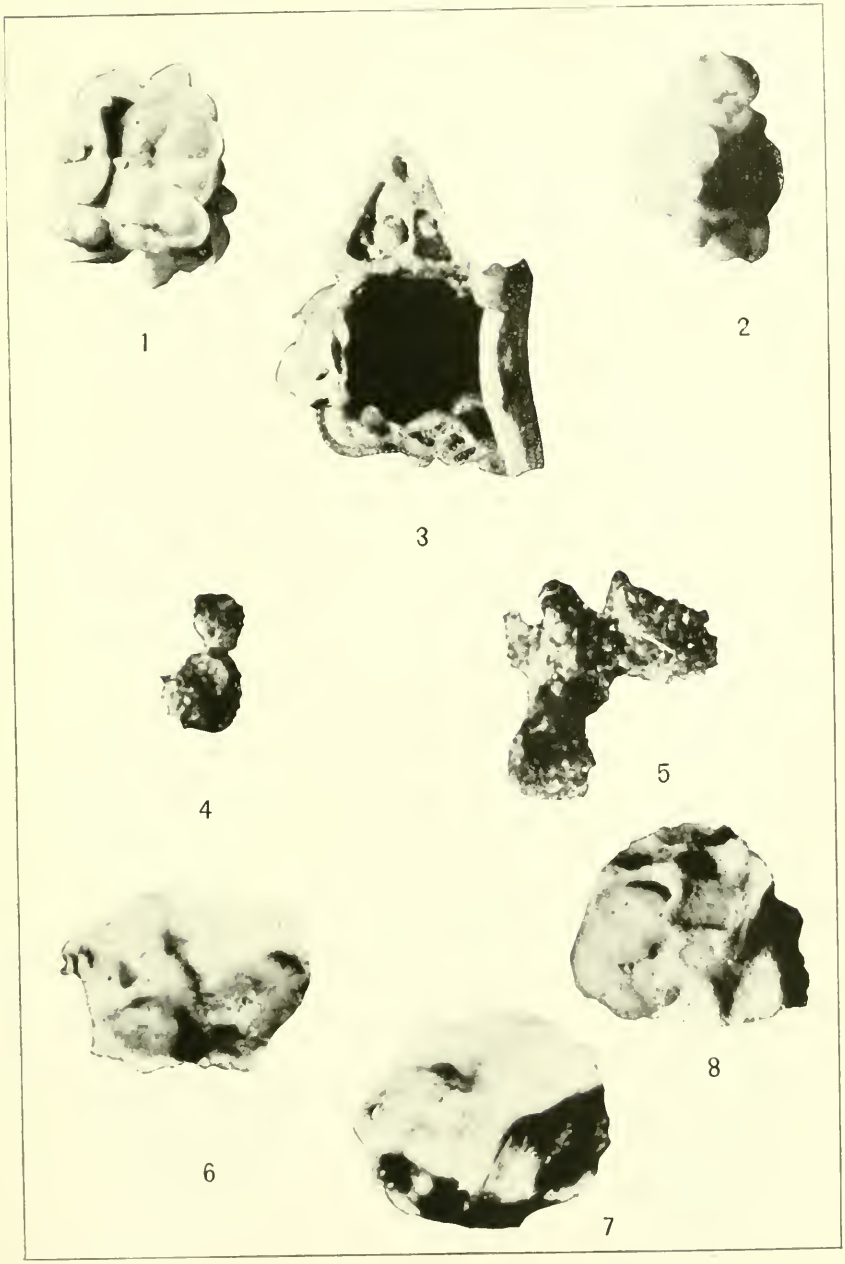

ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

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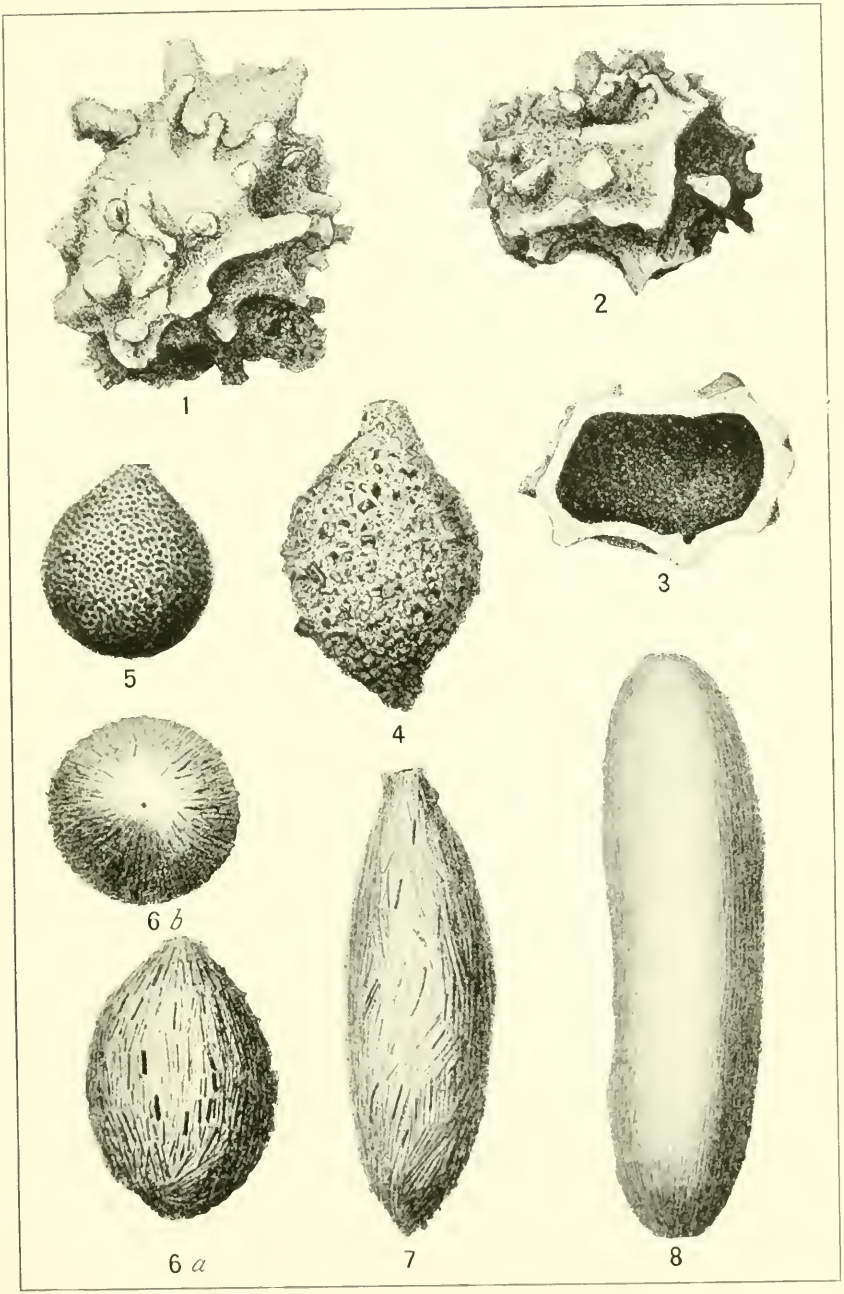

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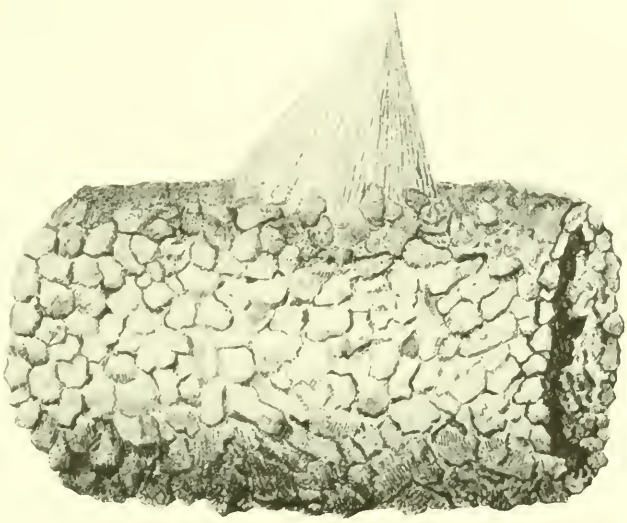

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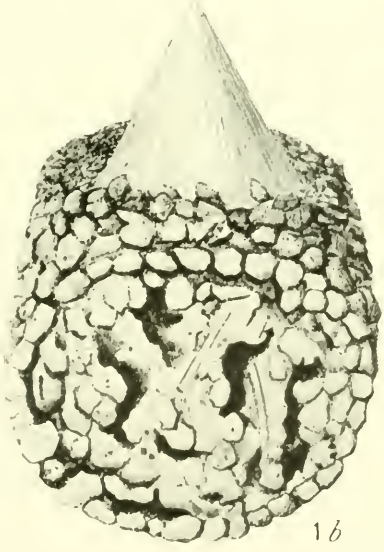


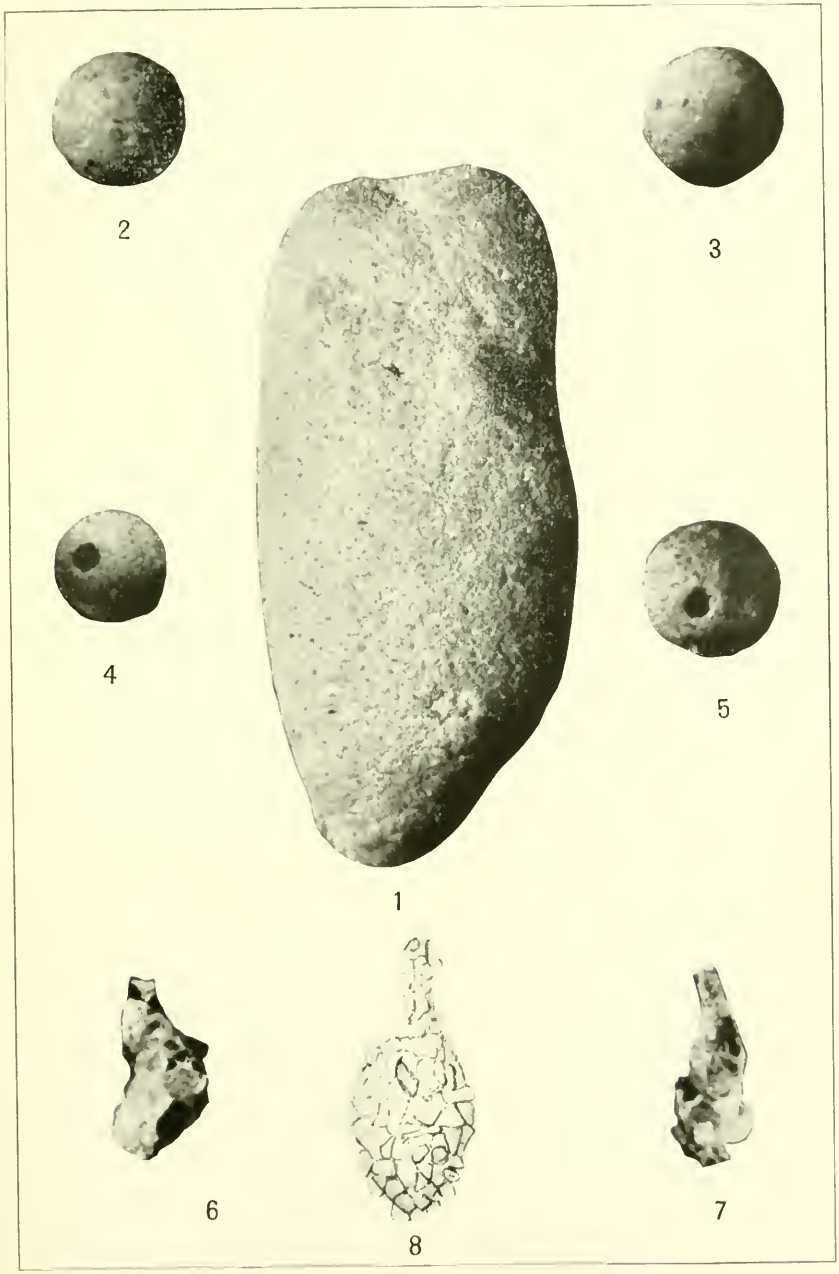
1*b*

ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGE 105.

ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGE 105.



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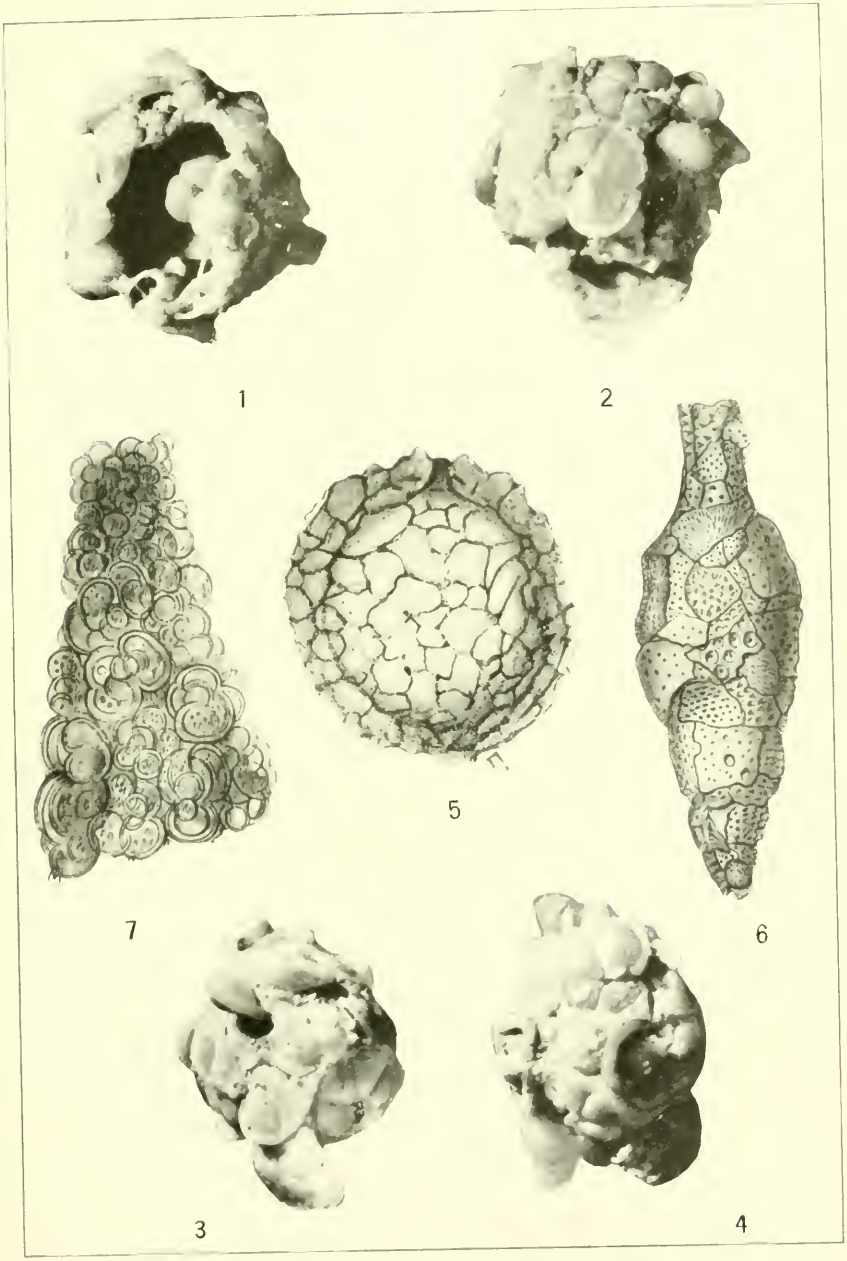

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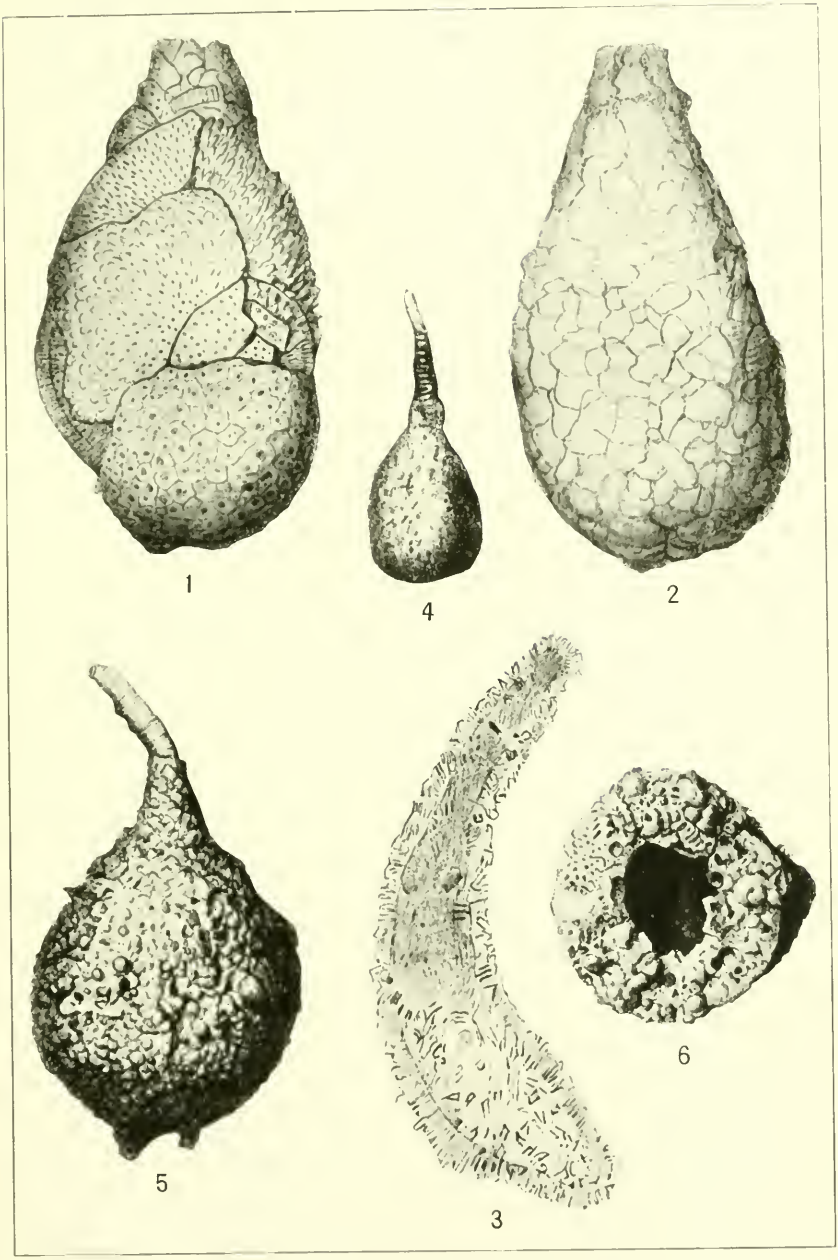

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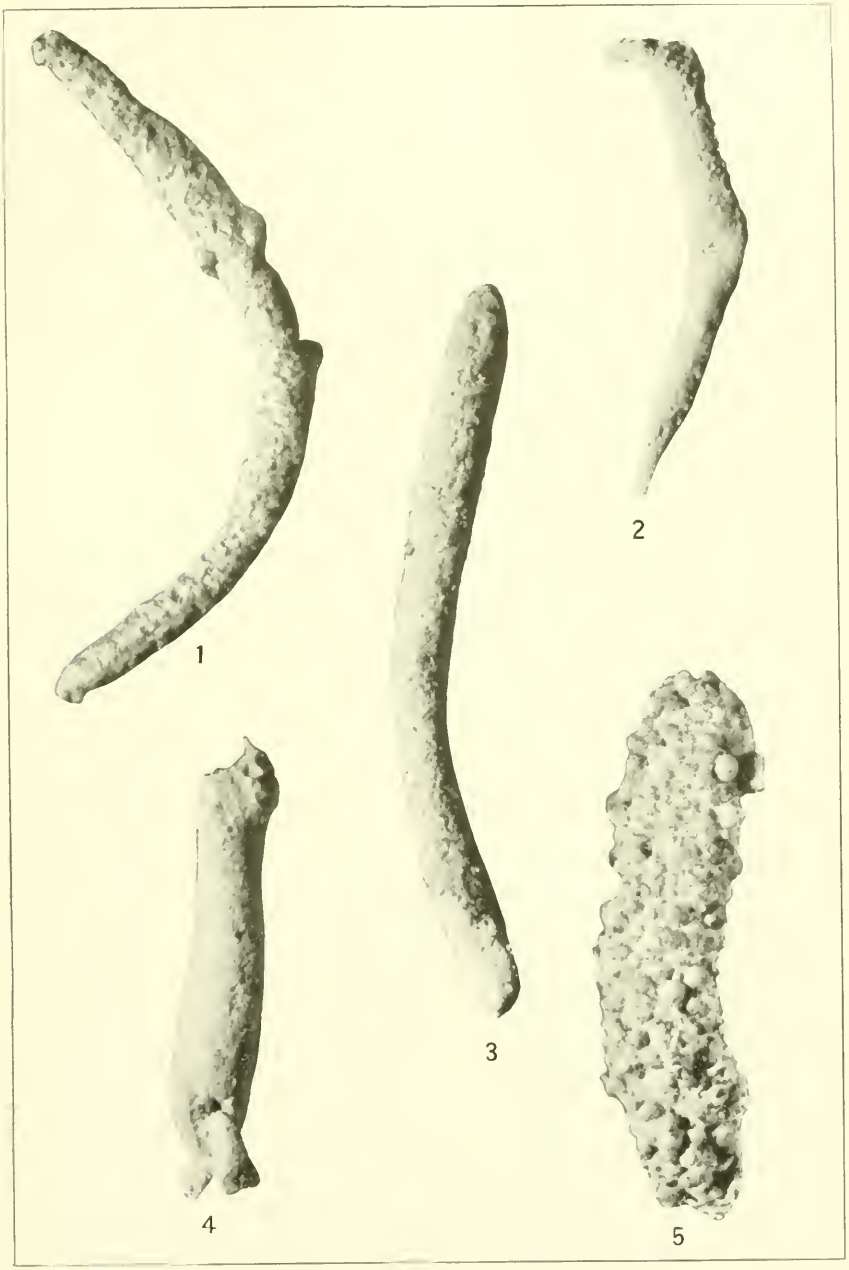
FOR EXPLANATION OF PLATE SEE PAGE 106.



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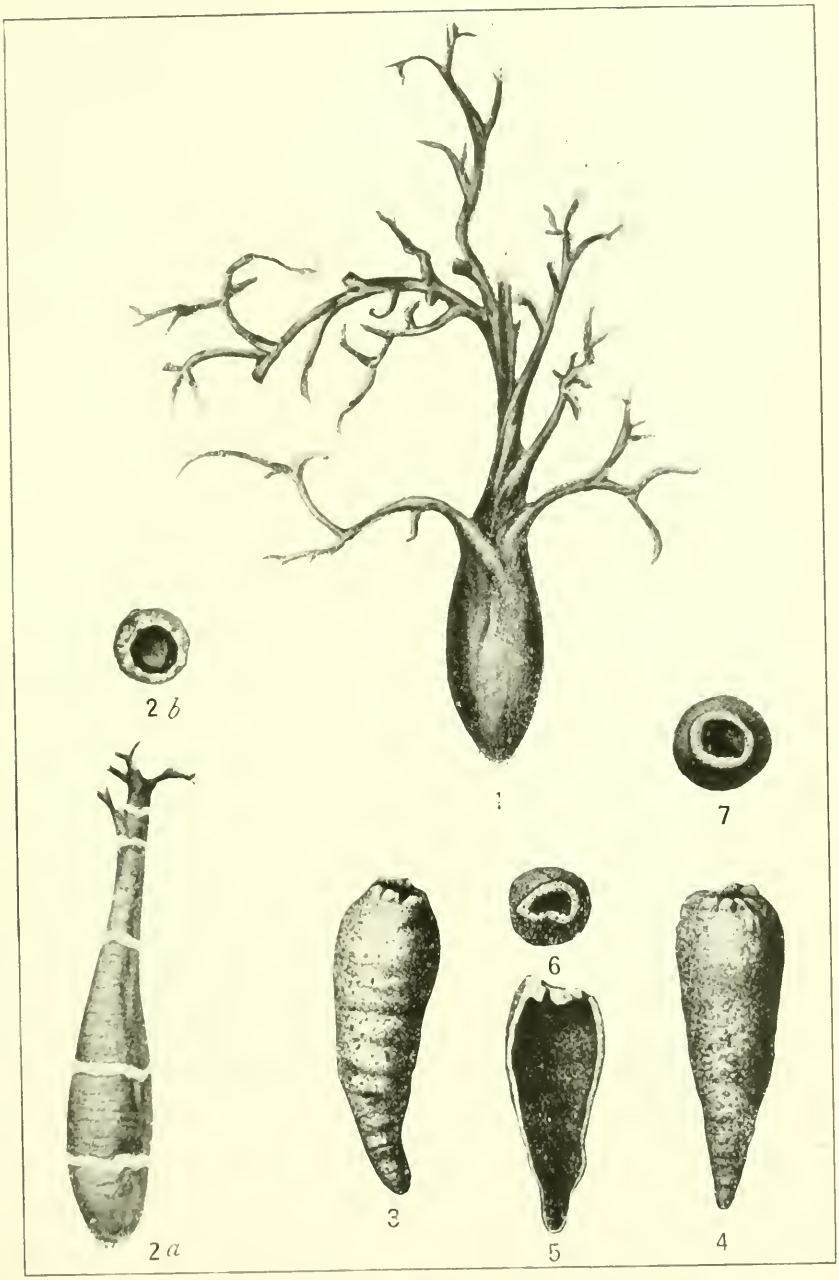

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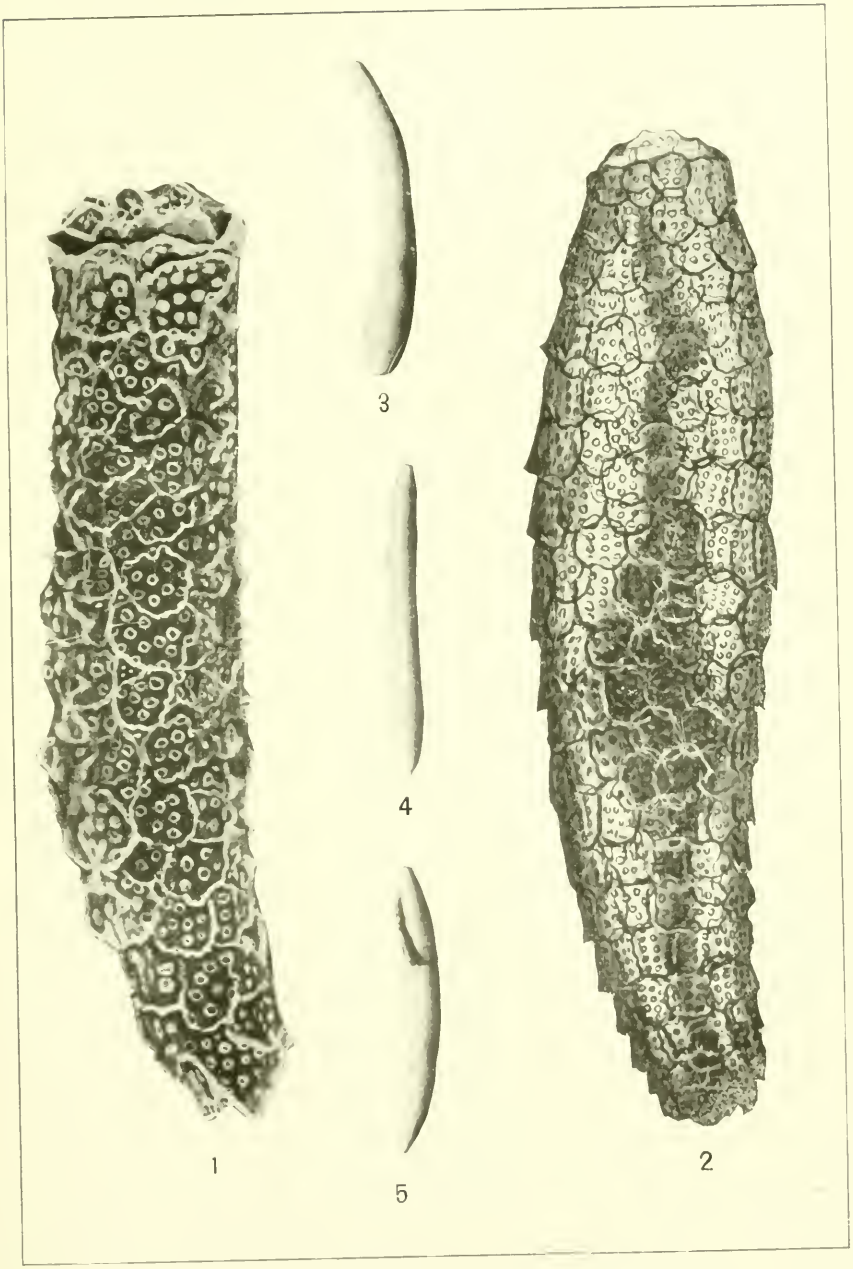

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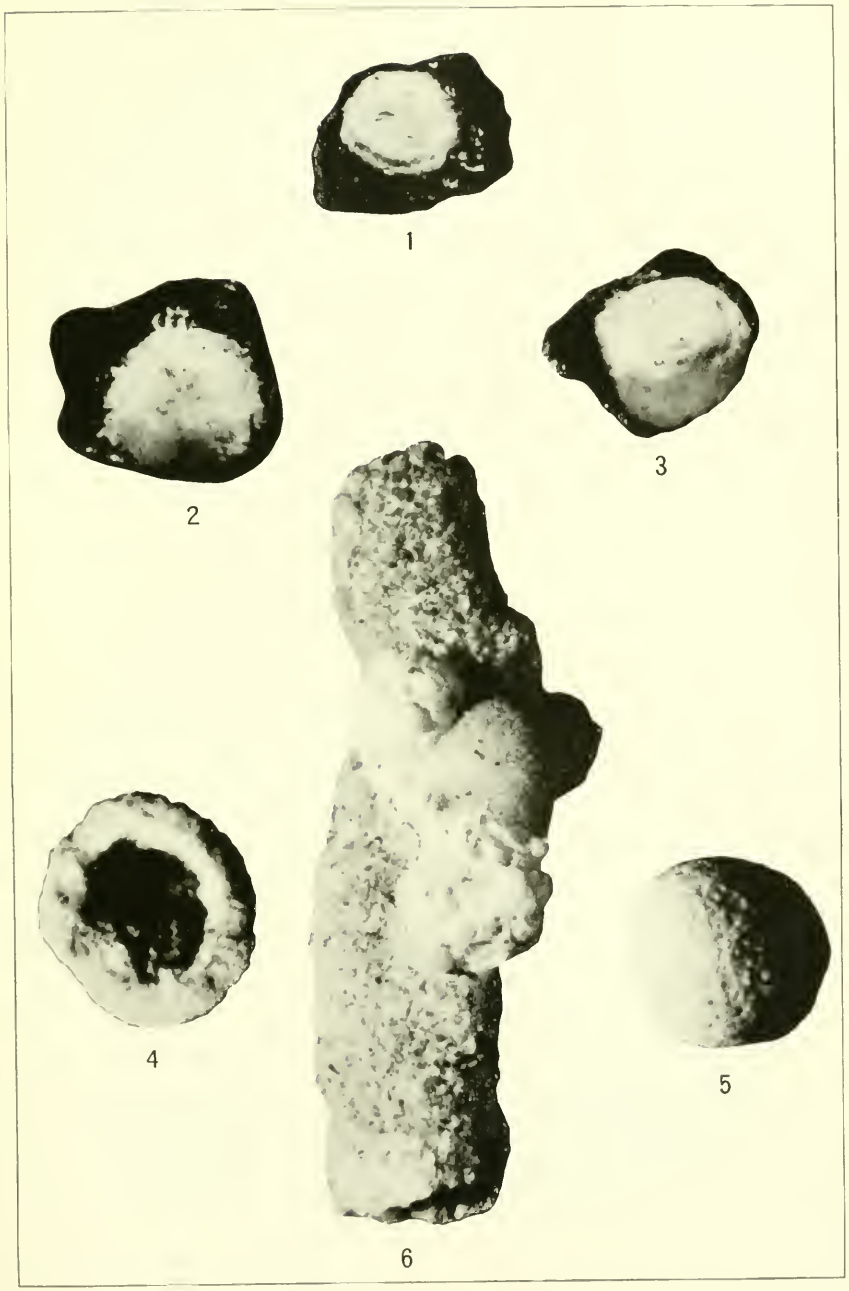

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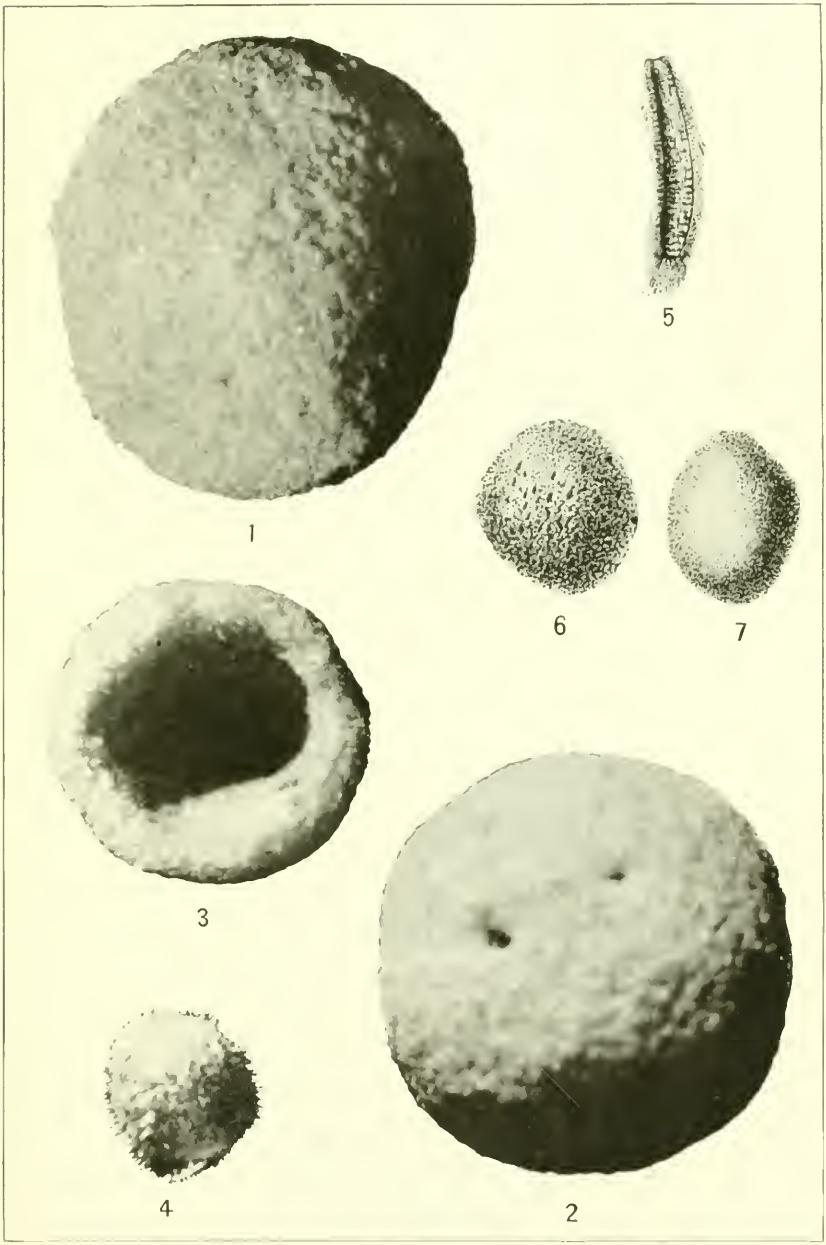

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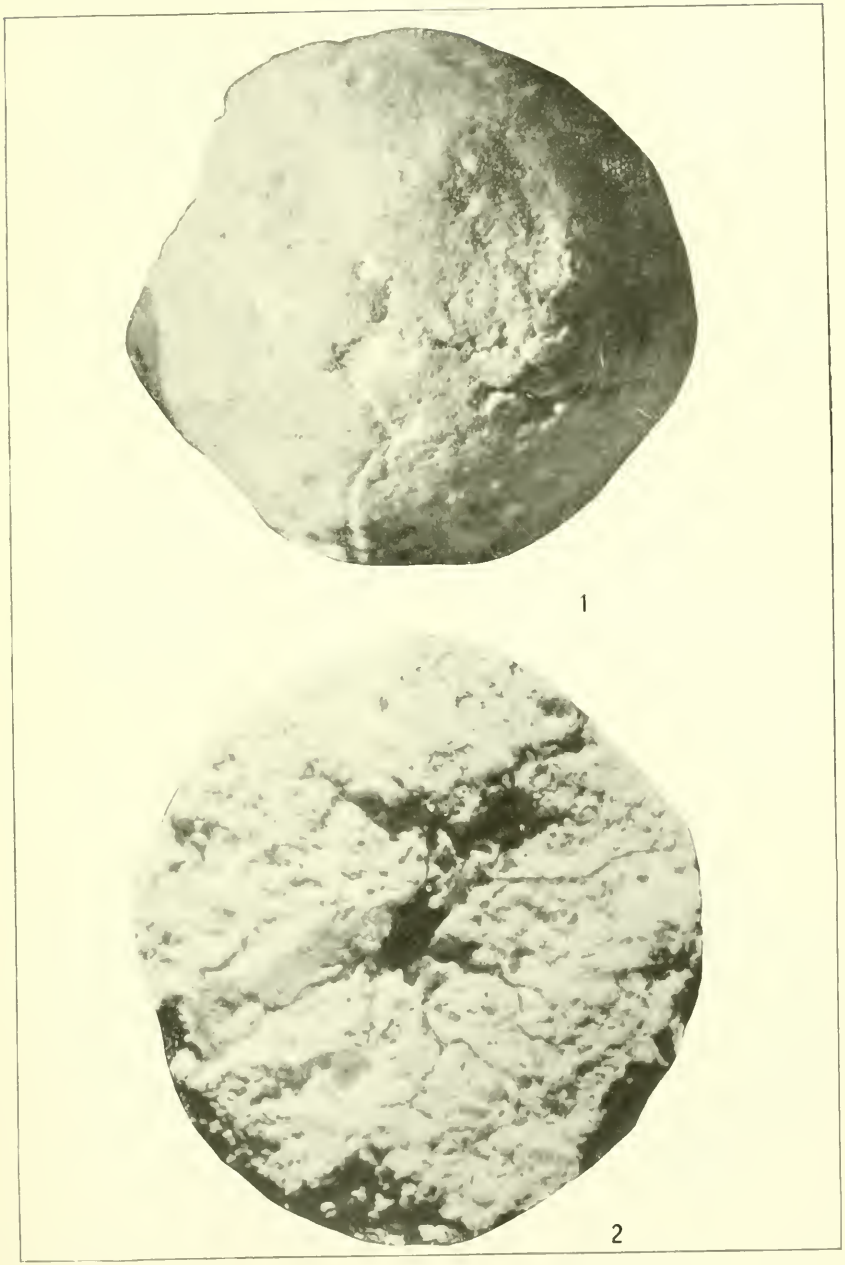

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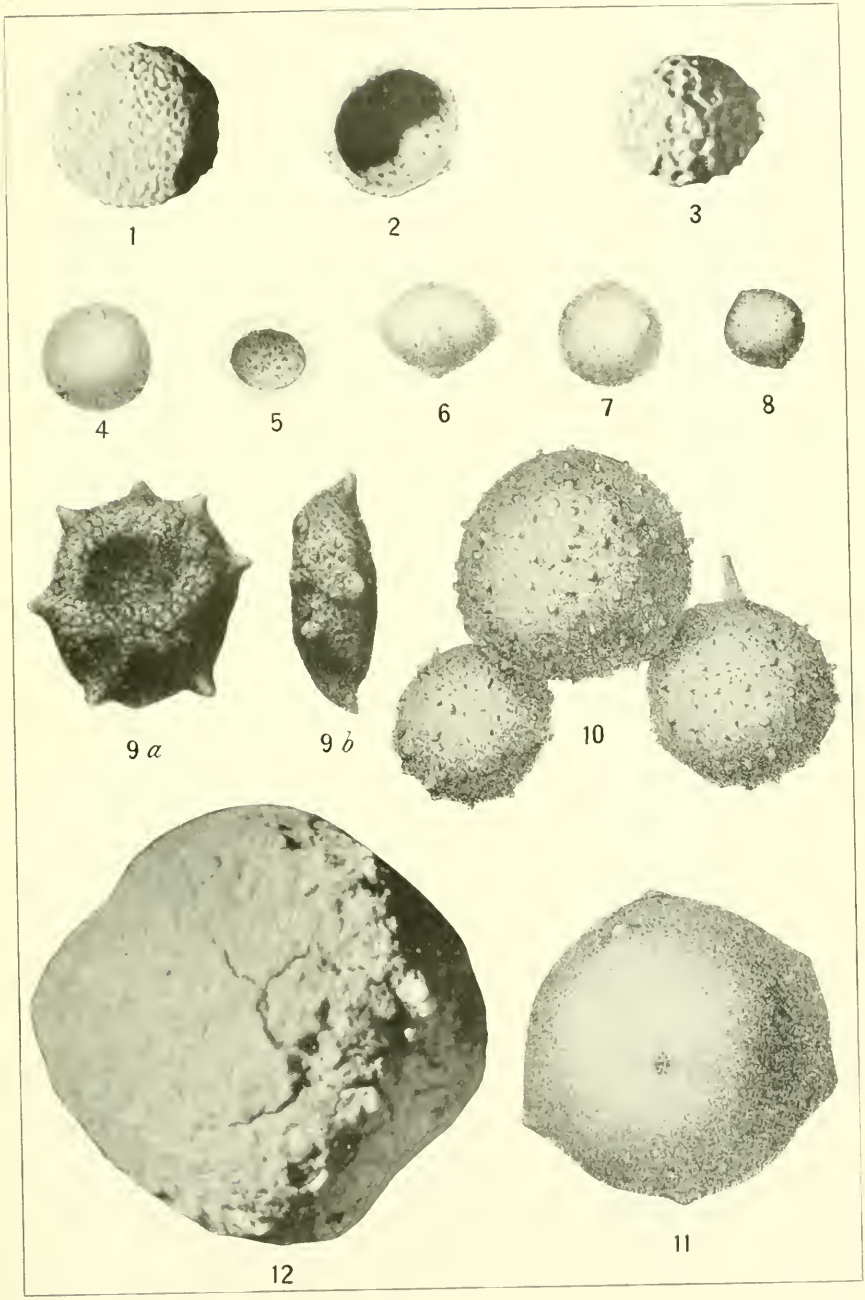

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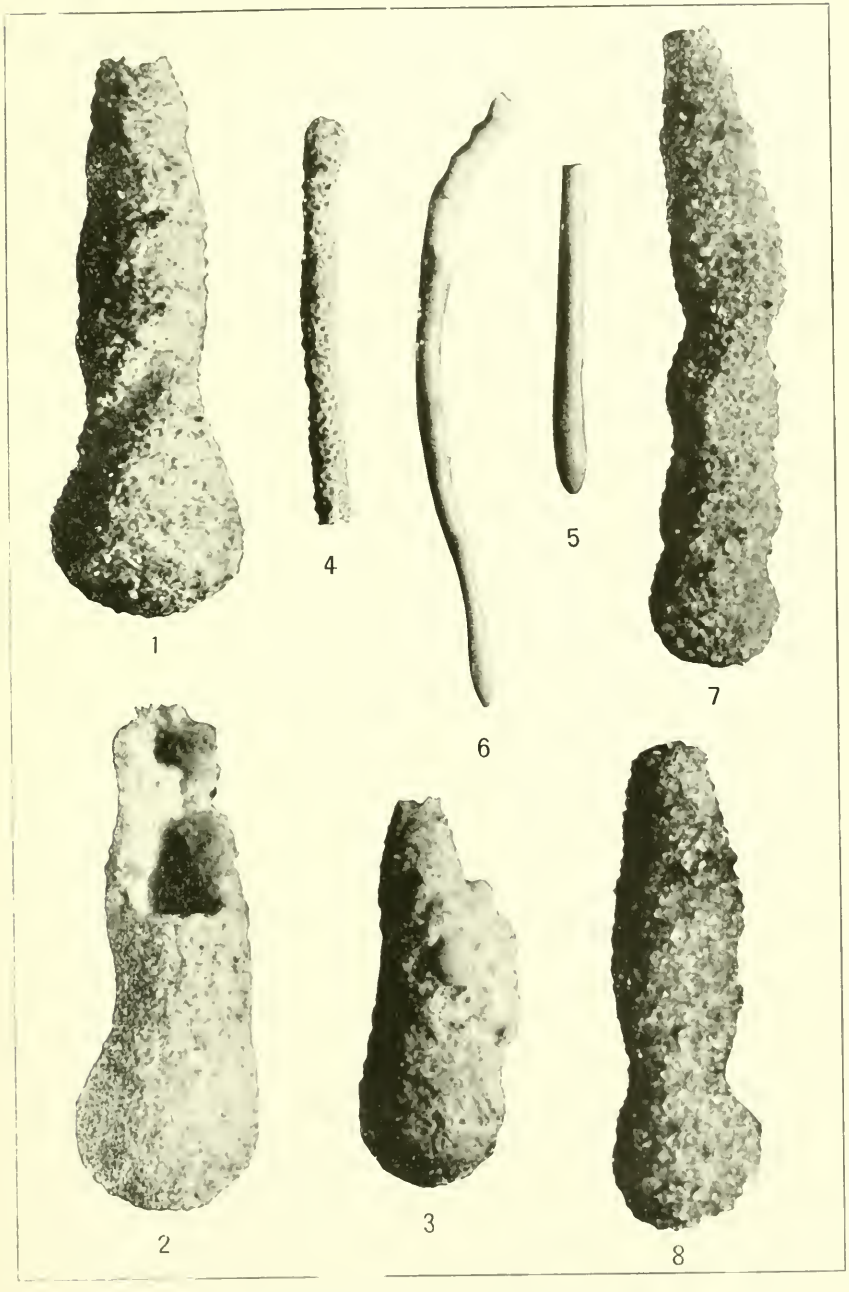

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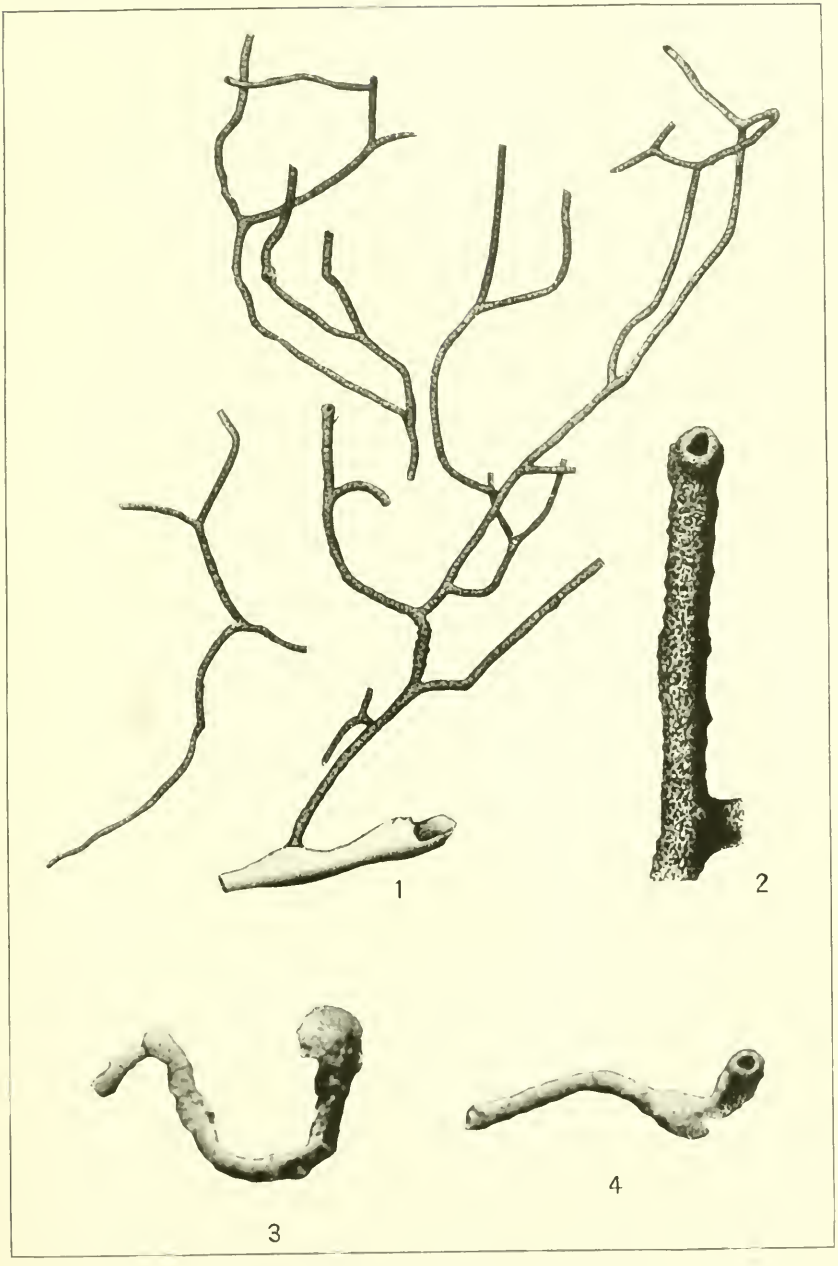

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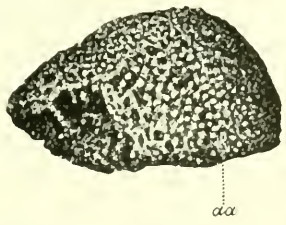

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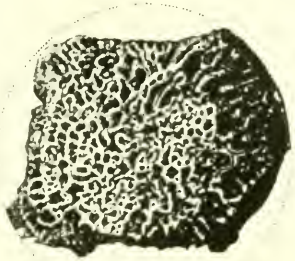

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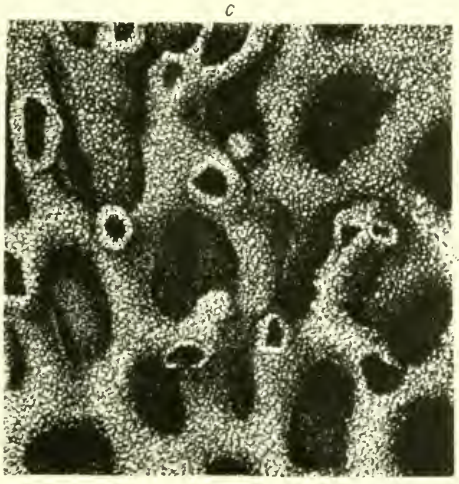

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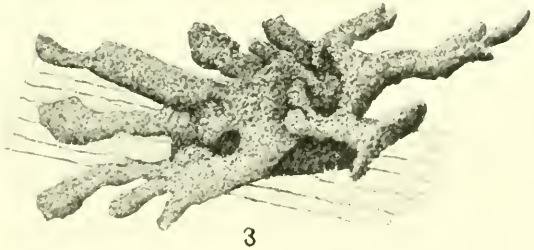

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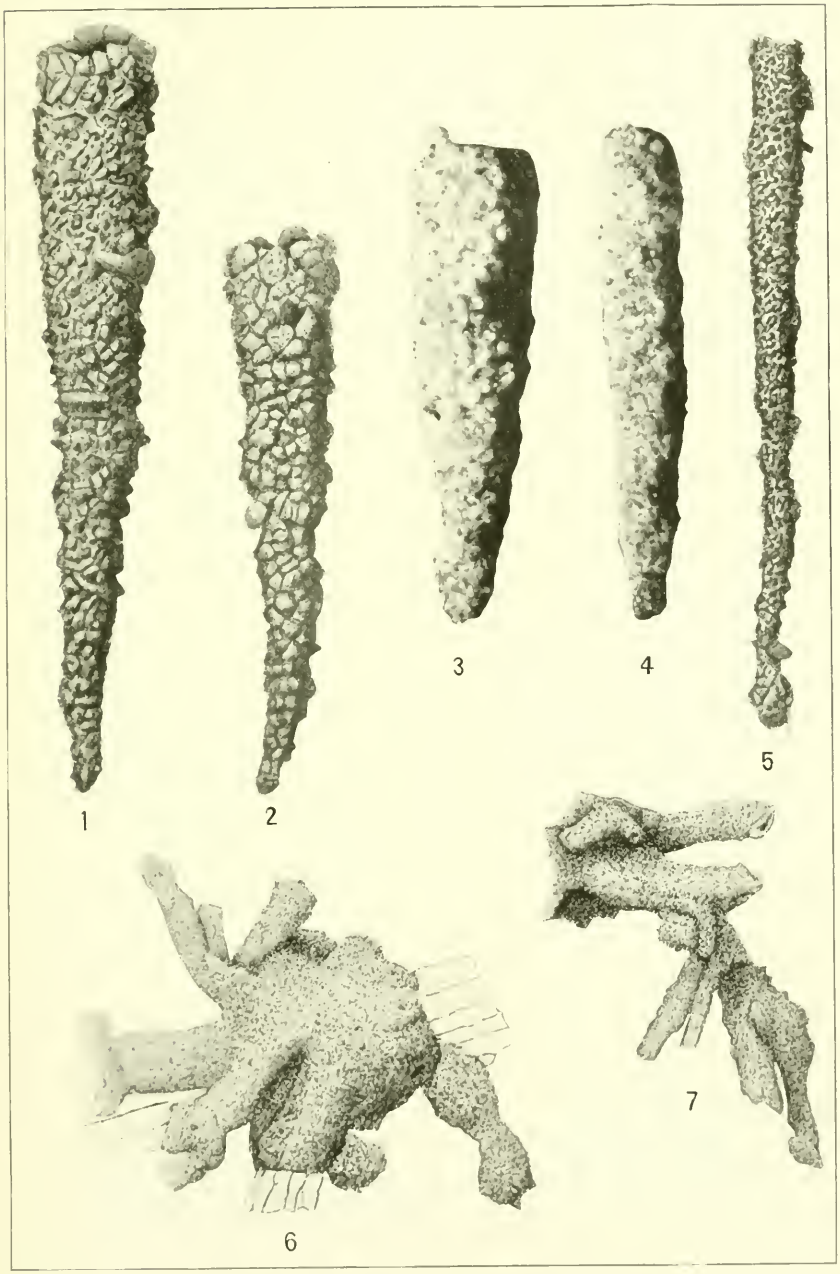
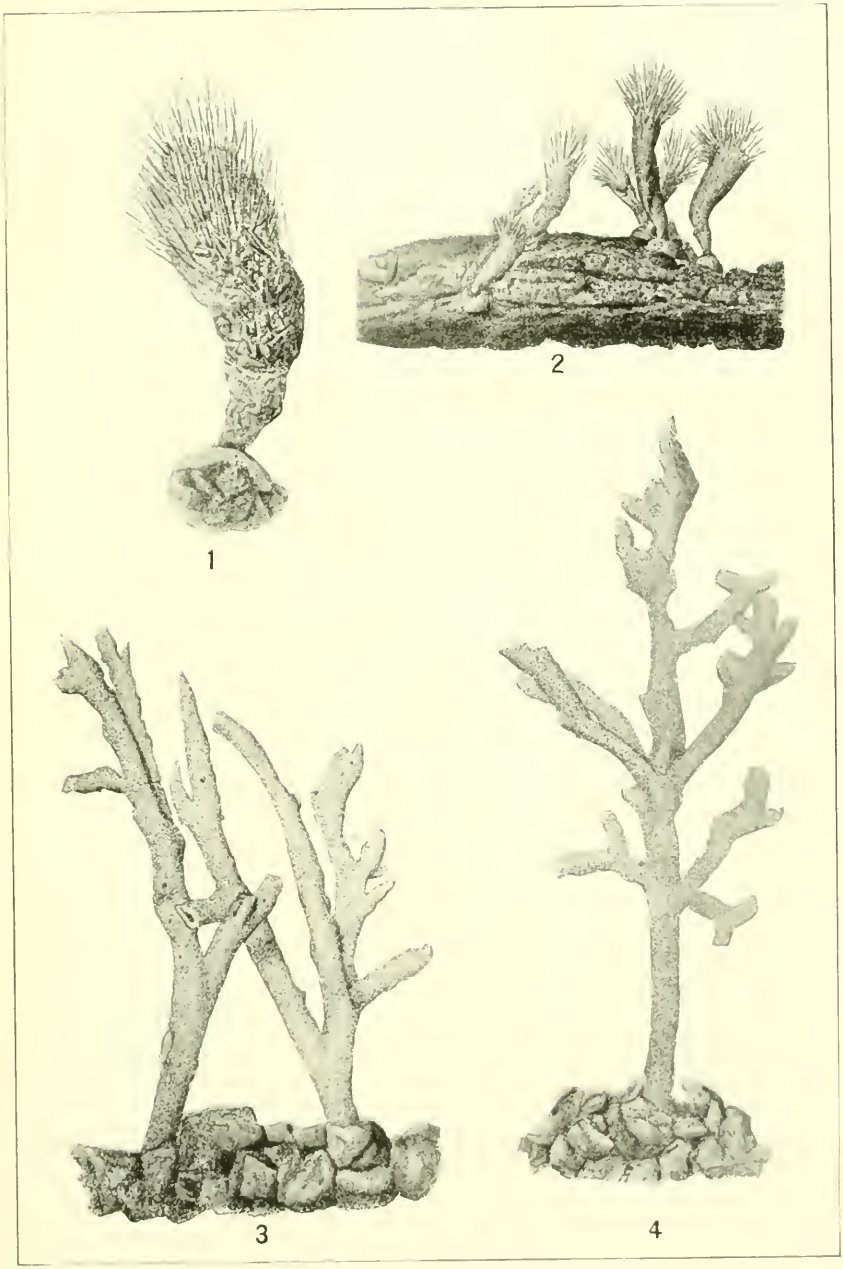
FOR EXPLANATION OF PLATE SEE PAGE 107.



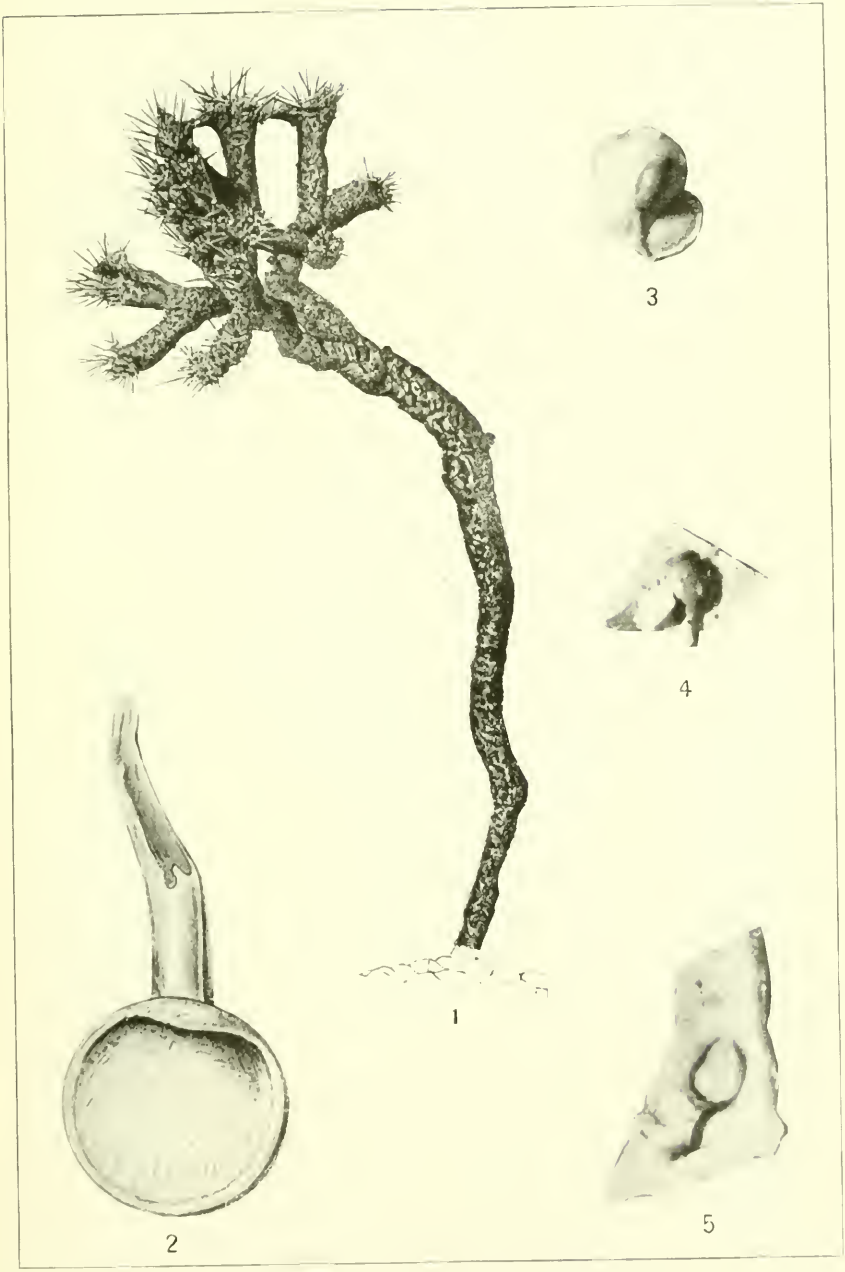
ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGE 107.



ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGE 107.



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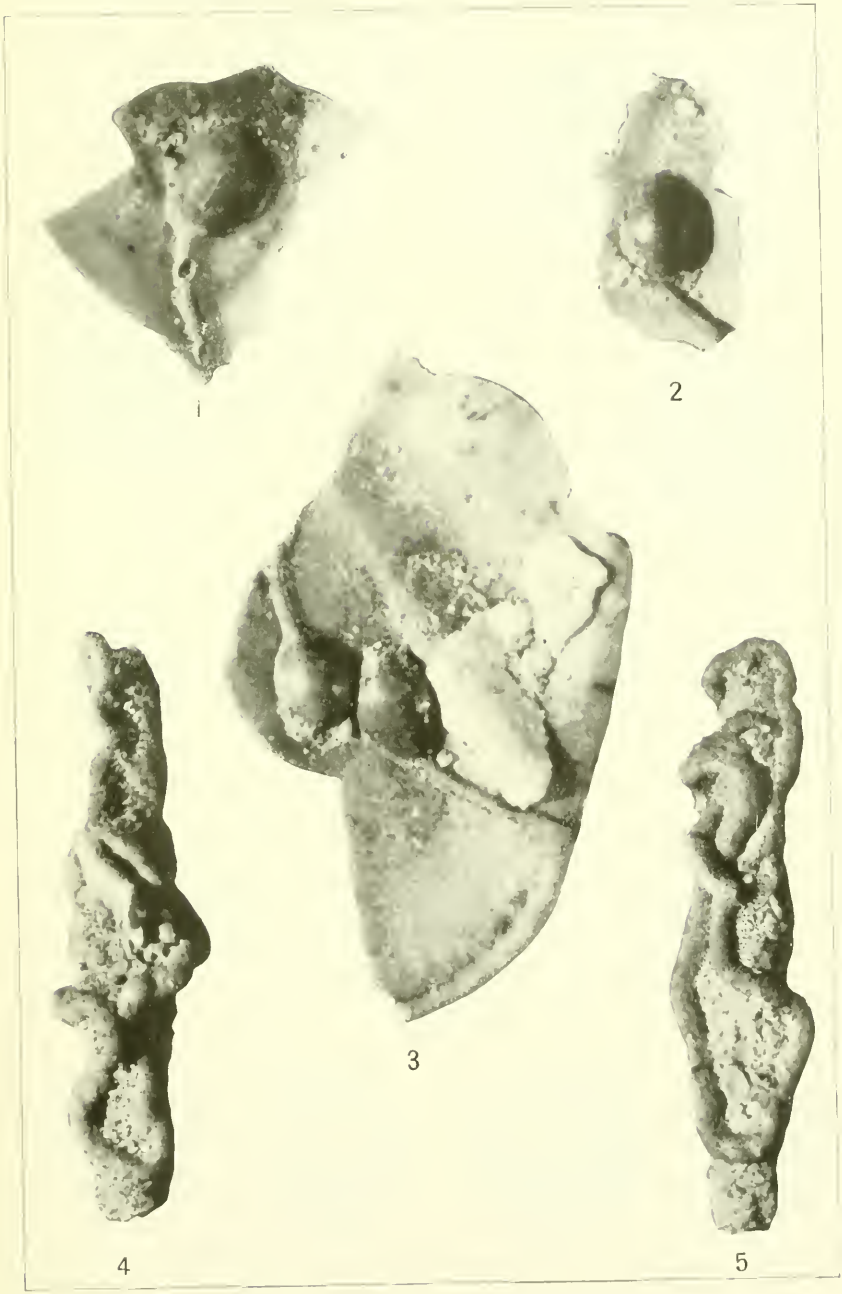
FOR EXPLANATION OF PLATE SEE PAGES 107 AND 108.



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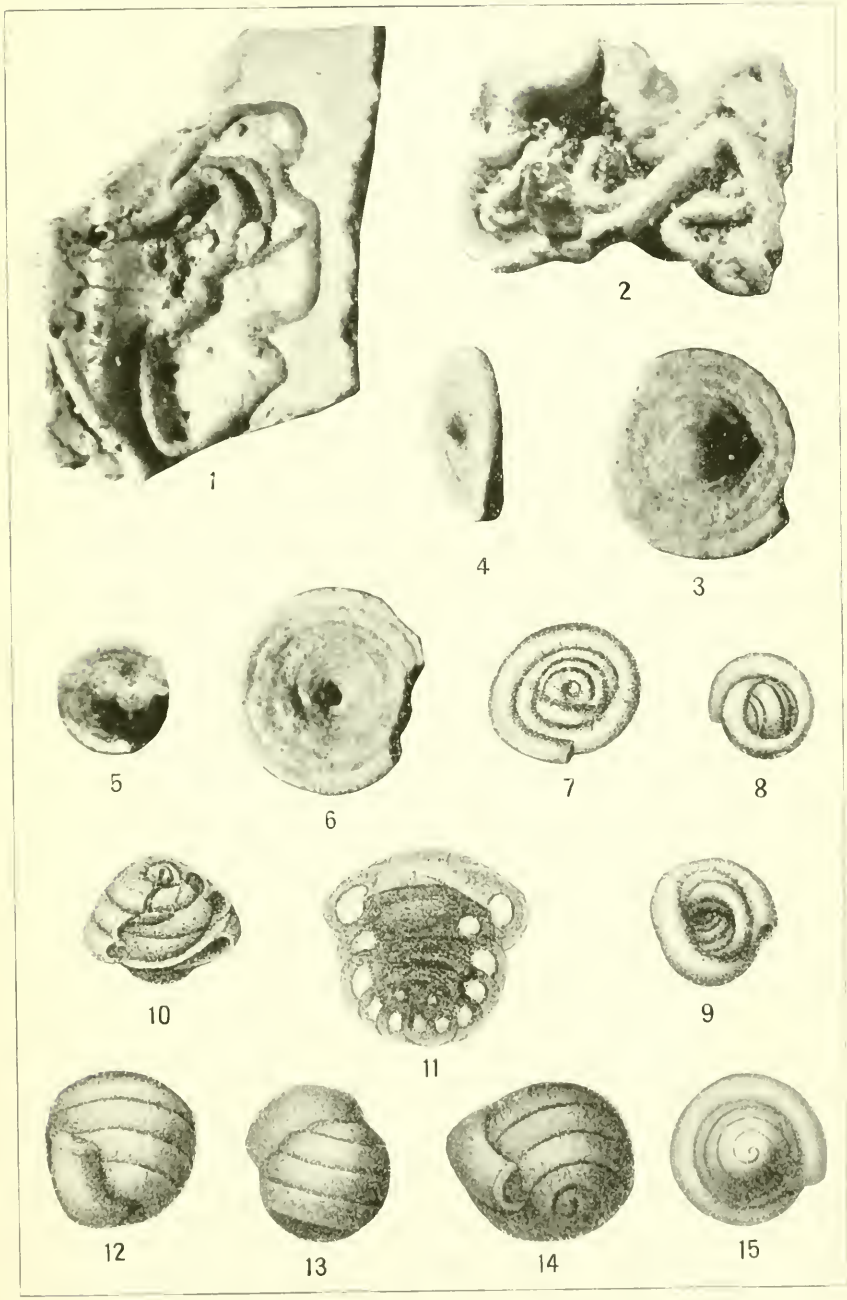
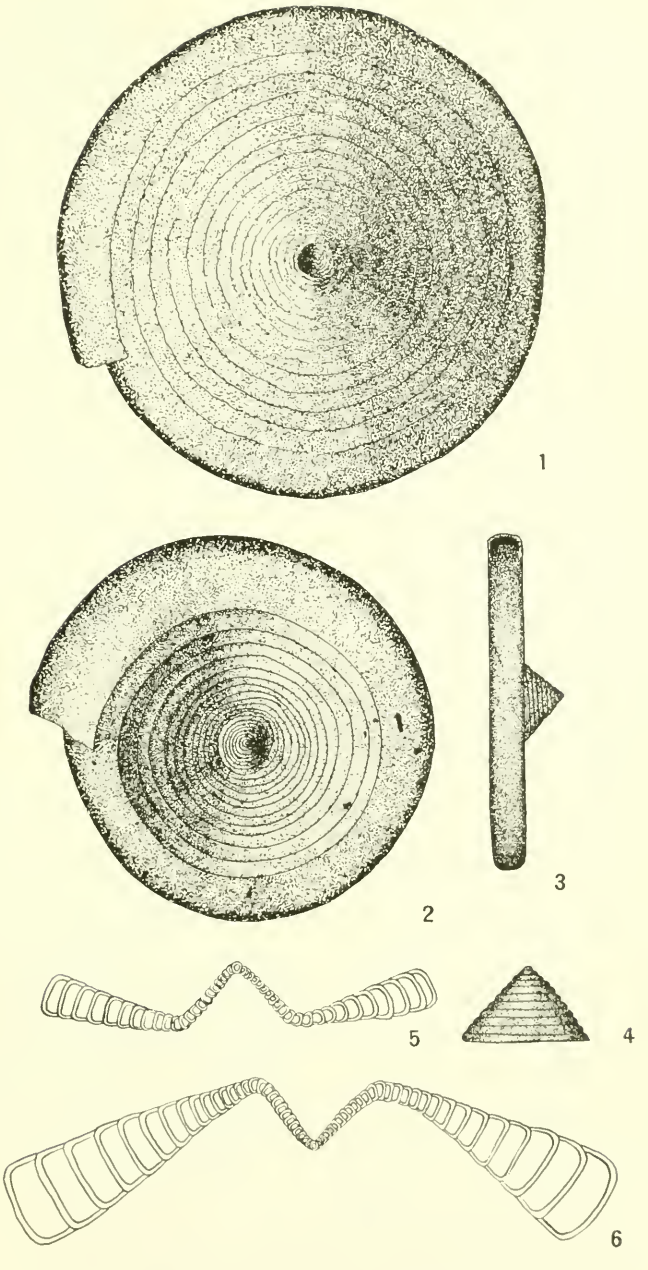
FOR EXPLANATION OF PLATE SEE PAGE 108.



ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGE 108.



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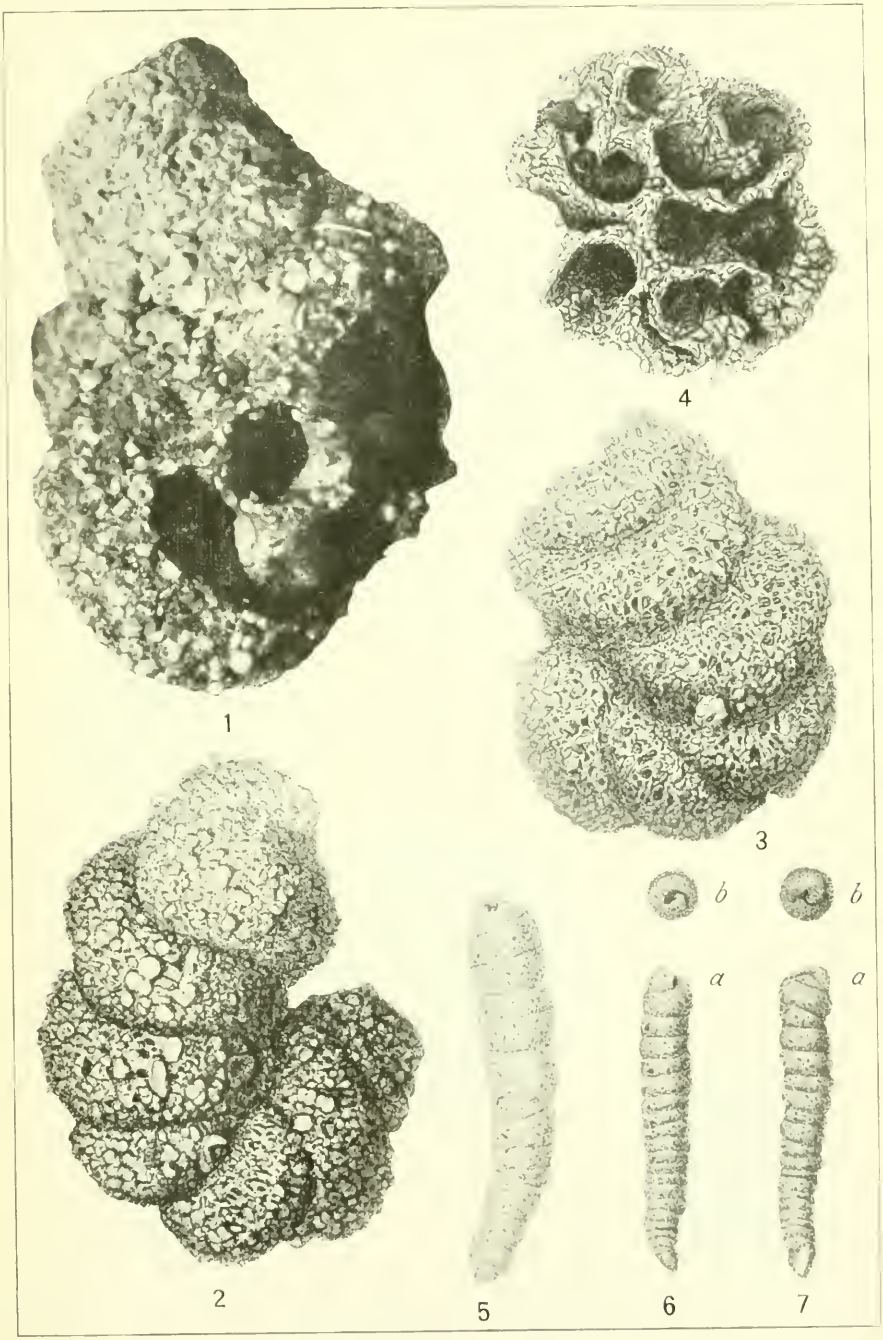
FOR EXPLANATION OF PLATE SEE PAGE 108.



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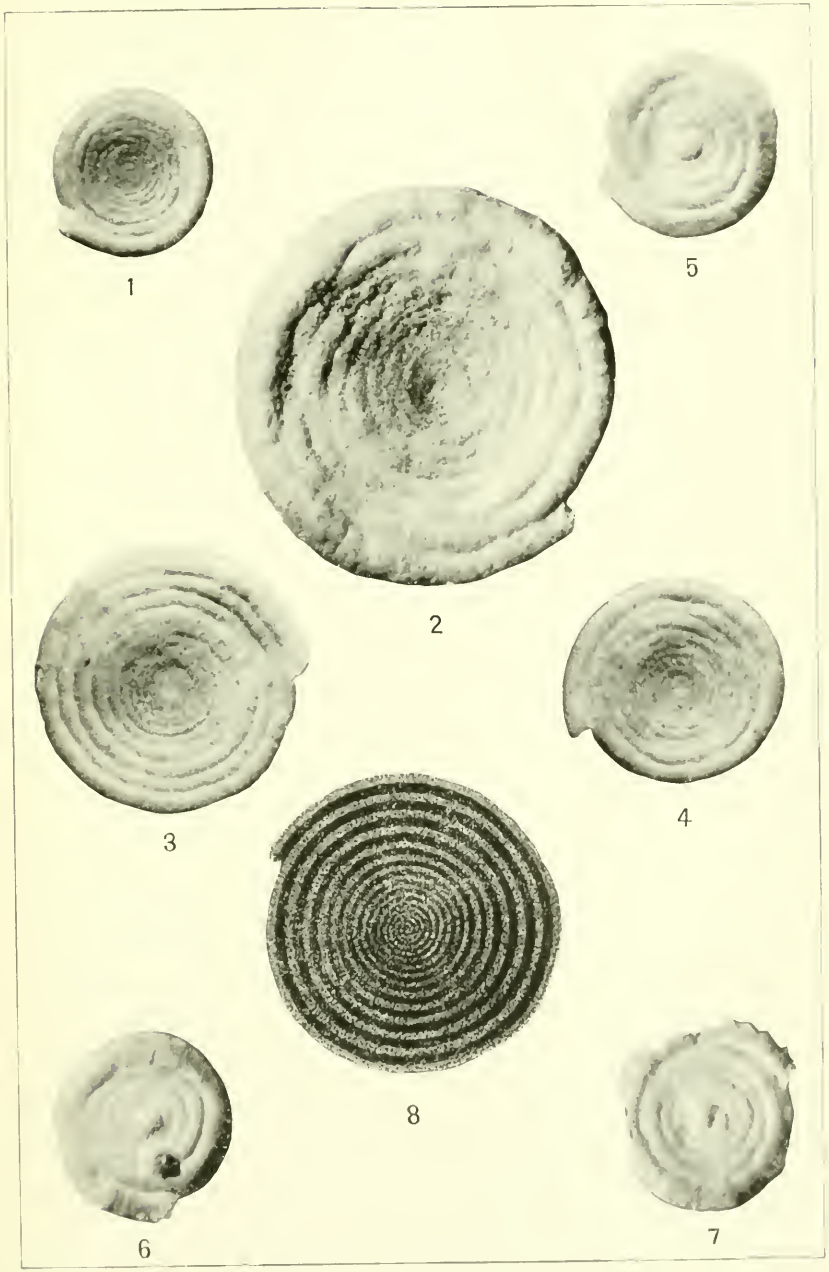
FOR EXPLANATION OF PLATE SEE PAGE 108.



ASTRORHIZIDAE OF THE ATLANTIC OCEAN.

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